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NEUTRON CROSS SECTIONS FOR ALUMINUM

by

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GENERAL ATOMIC

DIVISION OF

GENERAL DYNAMICS

JOHN JAY HOPKINS LABORATORY FOR PURE AND APPLIED SCIENCE

P.O. BOX 608, SAN DIEGO, CALIFORNIA 92112

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TOPICAL REPORT

NEUTRON CROSS SECTIONS FOR ALUMINUM

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G. D. Joanou
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I. INTRODUCTION

A set of neutron cross sections has been prepared for aluminum. These data are based on existing experimental data whenever possible. Gaps in the existing data have been filled by theoretical calculations and in some cases by "educated" guesses.

The compiled and evaluated data have been incorporated into the GAM-II⁽¹⁾ slowing down program and into the GATHER-II⁽²⁾ thermalization program. The literature survey associated with this report is believed to be complete to November, 1964.

II. DISCUSSION

2.1 POSSIBLE NEUTRON REACTIONS WITH ALUMINUM

The possible neutron reactions with aluminum in the energy range 0.001 eV to 15 MeV are tabulated in Table 1.⁽³⁾

2.2 RESONANCE PARAMETERS

Resonance parameters for aluminum are shown in Table 2.^(4, 5)

2.3 TOTAL CROSS SECTION

The total cross sections for aluminum are fairly well known over the entire range of interest.^(5, 21) The evaluated data are listed in Table 3 and shown in Figs. 1 to 5.

2.4 TOTAL ELASTIC CROSS SECTION

Since only a few measurements^(5, 23) of the total elastic scattering cross sections have been made, it was felt that it was more reliable to obtain the elastic cross sections by subtracting the non-elastic cross section from the total cross section. The resulting elastic cross section is shown in Table 3.

2.5 n, p REACTION

The n, p cross sections are fairly well known over the entire range of interest.^(5, 10, 22, 24-26) A gap exists in the data between approximately

8 and 11 MeV. The evaluated data is tabulated in Table 3 and shown in Fig. 6,

2.6 n, α REACTION

Although a considerable discrepancy exists between the measurements of Butler and Santry⁽²⁷⁾ and Tewes, *et al.*,⁽²⁸⁾ over a portion of the energy range considered, it is felt that the n, α cross section is reasonably well known for aluminum.⁽⁵⁾ We have, perhaps somewhat arbitrarily, discarded the measurements of Tewes, *et al.*, in this evaluation. The resulting evaluated data are shown in Table 3 and Fig. 7.

2.7 n, np REACTION

The threshold for the n, np reaction in aluminum is 8.53 MeV. Several measurements have been made around 14 MeV.^(29, 30) The data shown in Table 3 were obtained by drawing a typical curve for this reaction from the threshold through the measurements at 14 MeV.

2.8 n, He^3 REACTION

Two measurements^(31, 32) of the n, He^3 cross section have been made at 14.5 and 14.8 MeV. Although the threshold reported for this reaction by Howerton, *et al.*, is 15.21 MeV, the existing data imply a cross section of less than 70 mb at approximately 14.5 MeV.

2.9 n, t REACTION

A single measurement of the n, t cross section has been made by Pocularikas and Gardner⁽³³⁾ at 14.8 MeV. The reported cross section is less than 0.0122 mb.

2.10 n, γ REACTION

The n, γ cross section has been well measured throughout most of the energy range considered.^{(5, 22)*} The cross section at 2200 m/sec has been taken to be 233 mb. The resulting data are shown in Table 3 and Figs. 8 and 9.

2.11 DIFFERENTIAL ELASTIC SCATTERING CROSS SECTION

The differential elastic scattering cross sections have been represented in the following manner:

* It should be noted that the data shown in Ref. 5 have been misplotted.

$$\sigma(E, \mu) = \frac{\sigma_s(E)}{4\pi} \sum_{\ell} (2\ell + 1) f_{\ell}(E) P_{\ell}(\mu) \quad (1)$$

where $\sigma(E, \mu)$ is the scattering cross section per unit solid angle in the center of mass system for a neutron of energy E scattered through an angular deflection given by $\cos^{-1}\mu$.

A least squares fit to the existing measurements was used to calculate the expansion coefficients for aluminum.

The Legendre coefficients shown in Table 4 were obtained by plotting the expansion coefficients derived from the existing experimental data versus energy and drawing smooth curves through the data. Since the experimental data were somewhat limited,⁽³⁴⁻⁵⁰⁾ the results shown in Table 4 represent an average behavior of the Legendre coefficients through the aluminum resonances.

2.12 INELASTIC CROSS SECTIONS

The energy level scheme of aluminum is as follows:⁽⁴⁾ 0($5/2^+$), 0.842($1/2^+$), 1.013($3/2^+$), 2.210($7/2^+$), 2.73($5/2^+$), 2.976($3/2^+$), 3.0($9/2^+$), 3.674($1/2^+$), 3.951($7/2^+$), 4.052($3/2^+$), 4.403($5/2^+$), 4.504($5/2^+$), 4.576($11/2^+$), 4.81($3/2^+$). A series of optical model and Hauser-Feshbach calculations have been made by Forsberg⁽⁴⁾ to fit the existing measurements for the excitation of individual levels.^(45, 52-54) The fit to the measurements is reasonably good and is tabulated in Table 5 and shown in Figs. 10 to 23.

2.13 n, 2n REACTION

The n, 2n cross section data shown in Table 3 were taken from the measurements of Moni, et al.⁽⁵⁵⁾

2.14 NONELASTIC CROSS SECTION

The nonelastic cross section was calculated in the following manner:

$$\sigma_{\text{non}} = \sigma_{n,\alpha} + \sigma_{n,\gamma} + \sigma_{\text{in}} + \sigma_{n,p} + \sigma_{n,\text{He}^3} + \sigma_{n,np} + \sigma_{n,2n} \quad (2)$$

The nonelastic cross section calculated in this manner is in reasonable agreement with the available direct measurements⁽⁵⁾ of this quantity.

Table 1

POSSIBLE NEUTRON REACTIONS IN ALUMINUM
IN THE ENERGY RANGE BELOW 15.0 MEV

<u>Reaction</u>	<u>Threshold (MeV)</u>
n, 2n	13.51
n, p	1.90
n, np	8.53
n, d	6.21
n, t	11.28
n, He ³	15.21
n, α	3.25
n, n α	10.44

Table 2

RESONANCE PARAMETERS FOR ALUMINUM

<u>E_o (keV)</u>	<u>Γ(keV)</u>	<u>J</u>	<u>ℓ</u>
5.906	0.02		1
35.04	1.5	3	0
84.6	5	1	1
86.6	2.4	3	0
89.1	2.0	1	1
91.5	4.0	2	0
119.7	3.0	2	1
140.0	5.0	1	1
143.3	3.5	3	0
149.0	3.0	2	1
152	3.0	1	1
158.4	4.0	4	1
163.0	2	1	1
166.5	1.8	1	1
169	2.5	0	2
172	2	1	1
175.5	3	0	2
179	2	1	1
182	2	0	2
185.5	2.5	0	2
190.5	3	0	2

Table 2 (Cont.)

RESONANCE PARAMETERS FOR ALUMINUM

E_o (keV)	Γ (keV)	J	ℓ
195	2	0	2
204	7	2	1
209	1.8	1	1
212	2	2	1
217	1.5	2	1
223	3	2	1
229	2	1	1
233	2	1	1
237.5	1.5	1	1
240.5	1.5	1	1
243	1	1	2
245.5	1.5	1	1
250.5	3	0	2
257	5	1	1
266	1.5	0	2
271	1.5	0	2
278	5	3	0
284	2.5	1	1
288	3	2	1
292	1.5	1	2
294.5	2	2	1
300	4	2	1
305.5	2	2	1
309	2	2	1
311.8	4	3	0
316.5	1.5	0	2
329.5	1.5	0	2
342	1.5	0	2
366	5	4	1
370	2	1	2
374	3.5	2	1
384.8	4	2	0
404.5	2	1	2
407.5	2	1	2
411	2	3	2
416.5	3.5	3	1
420.5	1.5	3	2
423	1.5	2	2
426	2.5	2	2

Table 2 (Cont.)

RESONANCE PARAMETERS FOR ALUMINUM

<u>E_o (keV)</u>	<u>Γ (keV)</u>	J	λ
433	4	4	1
437.5	1.5	2	2
439.5	1.4	2	2
442	1.5	3	2
445	1.5	3	2

Table 3
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\alpha}$ (mb)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	$\sigma_{n,t}$ (mb)	σ_{n,He^3} (mb)	$\sigma_{n,np}$ (mb)	$\sigma_{n,2n}$ (mb)	σ_{in} (barns)	σ_a (mb)
15.0	1.742	1.147	0.595	110.0	0.55	60.0	0.0	0.0	20.0	5.0	0.956	186.5
14.5	1.74	1.109	0.631	116.0	0.54	63.0			19.0	3.0	0.910	198.5
14.0	1.74	1.050	0.690	124.0	0.53	67.0			18.5	2.0	0.840	210.0
13.5	1.74	0.999	0.741	128.0	0.50	72.0			17.5	0.0	0.781	218.0
13.0	1.744	0.955	0.789	132.0	0.47	75.0			16.5		0.731	223.9
12.5	1.758	0.920	0.838	130.0	0.45	83.0			15.5		0.691	229.0
12.0	1.762	0.883	0.879	122.0	0.41	87.0			15.0		0.659	224.4
11.5	1.775	0.861	0.914	115.0	0.36	95.0			14.0		0.637	224.4
11.0	1.750	0.848	0.902	108.0	0.32	102.5			12.0		0.625	222.8
10.5	1.66	0.843	0.817	100.0	0.27	110.0			11.5		0.621	221.8
10.0	1.66	0.841	0.819	90.0	0.24	112.5			10.0		0.628	212.7
9.8	1.75	0.843	0.907	88.0	0.23	112.4			9.0		0.633	209.6
9.7	1.77	0.840	0.930	85.0	0.21	111.0			8.0		0.636	204.2
9.6	1.77	0.839	0.931	83.0	0.20	110.0			7.0		0.639	200.2
9.5	1.75	0.840	0.910	81.0	0.19	109.5			6.0		0.643	196.7
9.4	1.725	0.839	0.886	79.0	0.18	107.6			5.0		0.647	191.8
9.3	1.71	0.837	0.873	77.0	0.18	104.0			4.0		0.652	185.2
9.2	1.70	0.834	0.866	74.0	0.18	100.0			3.0		0.657	177.2
9.1	1.70	0.826	0.874	72.0	0.18	90.0			2.0		0.662	164.2
9.0	1.70	0.827	0.873	71.0	0.18	88.0			1.00		0.667	160.2
8.9	1.70	0.829	0.871	68.0	0.18	87.0			0.00		0.674	155.2
8.8	1.70	0.832	0.868	65.0	0.18	86.7					0.680	151.9
8.7	1.70	0.836	0.864	63.0	0.19	86.2					0.687	149.4
8.6	1.71	0.839	0.871	59.0	0.19	85.6					0.694	144.8
8.5	1.72	0.844	0.876	58.0	0.20	85.0					0.701	143.2
8.4	1.73	0.849	0.881	54.0	0.21	84.4					0.710	138.6
8.3	1.74	0.854	0.886	52.0	0.22	83.8					0.718	136.0
8.2	1.75	0.854	0.896	48.0	0.23	83.2					0.723	131.4
8.1	1.76	0.865	0.895	46.0	0.25	82.6					0.736	128.9
8.0	1.80	0.870	0.930	43.0	0.27	82.0					0.745	125.3
7.9	1.86	0.878	0.982	41.0	0.28	82.0					0.755	123.2
7.8	1.94	0.885	1.055	40.0	0.28	80.0					0.765	120.3
7.7	1.94	0.898	1.042	38.0	0.28	85.0					0.775	123.2

Table 3 (Cont.)

NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\alpha}$ (mb)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	$\sigma_{n,t}$ (mb)	σ_{n,He^3} mb	$\sigma_{n,np}$ mb	$\sigma_{n,2n}$ mb	σ_{in} (barns)	σ_a (mb)
7.6	1.88	0.892	0.988	36.0	0.28	70.0	0.0	0.0	0.0	0.0	0.786	106.28
7.5	1.85	0.893	0.957	29.0	0.28	67.0	↓	↓	↓	↓	0.797	96.28
7.4	1.84	0.903	0.937	26.0	0.28	67.0	↓	↓	↓	↓	0.810	93.28
7.3	1.85	0.922	0.928	23.0	0.28	77.0					0.822	100.28
7.2	1.87	0.924	0.946	20.0	0.28	70.0					0.834	90.28
7.1	1.90	0.925	0.975	19.0	0.28	59.0					0.847	78.28
7.0	1.90	0.936	0.964	17.0	0.28	59.0					0.860	76.28
6.9	1.91	0.932	0.978	13.0	0.29	59.0					0.860	72.29
6.8	1.93	0.920	1.010	10.0	0.29	50.0					0.860	60.29
6.7	1.97	0.919	1.051	8.0	0.29	51.0					0.860	59.29
6.6	2.01	0.919	1.091	7.0	0.29	52.0					0.860	59.29
6.5	2.05	0.917	1.133	6.0	0.29	51.0					0.860	57.29
6.4	2.06	0.915	1.145	5.0	0.29	50.0						55.29
6.3	2.10	0.919	1.181	4.0	0.30	55.0						59.30
6.2	2.10	0.908	1.192	3.0	0.30	45.0						48.30
6.1	2.10	0.900	1.200	2.0	0.30	38.0						40.30
6.0	2.09	0.903	1.187	1.0	0.300	42.0						43.30
5.9	2.07	0.899	1.171	0.5	0.300	38.0						38.80
5.8	2.06	0.916	1.144	0.0	0.295	56.0						56.30
5.7	2.03	0.910	1.120		0.290	50.0						50.29
5.6	1.99	0.908	1.082		0.290	48.0						48.29
5.5	2.00	0.905	1.095		0.285	45.0						45.29
5.42	2.07	0.885	1.185		0.280	25.0						25.28
5.4	2.15	0.886	1.264		0.280	26.0						26.28
5.38	2.25	0.887	1.363		0.280	27.0						27.28
5.36	2.30	0.888	1.412		0.280	28.0						28.28
5.34	2.20	0.889	1.311		0.280	28.5						28.78
5.32	2.12	0.888	1.232		0.280	28.0						28.28
5.30	2.09	0.885	1.205		0.280	25.0						25.28
5.24	2.11	0.884	1.226		0.280	24.5						24.78
5.20	2.20	0.884	1.316		0.280	24.0						24.28
5.10	2.35	0.886	1.464		0.280	26.0						26.28
5.00	2.45	0.884	1.566		0.27	24.0						24.27
4.90	2.25	0.870	1.374		0.27	18.0					0.852	18.27
4.80	2.25	0.861	1.389		0.265	16.5					0.844	16.77

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\alpha}$ (mb)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	σ_{in} (barns)	σ_{ab} (mb)
4.75	2.25	0.858	1.392	0.0	0.265	17.5	0.840	17.77
4.70	2.25	0.856	1.394		0.260	20.0	0.836	20.26
4.64	2.25	0.853	1.397		0.260	22.0	0.831	22.26
4.55	2.23	0.843	1.387		0.255	19.0	0.824	19.26
4.50	2.20	0.838	1.362		0.255	17.0	0.821	17.26
4.40	2.24	0.829	1.411		0.253	13.5	0.815	13.75
4.30	2.23	0.819	1.411		0.250	10.7	0.808	10.95
4.20	2.27	0.810	1.460		0.245	8.6	0.801	8.85
4.10	2.40	0.803	1.597		0.240	7.5	0.795	7.74
3.90	2.39	0.785	1.605		0.235	7.0	0.778	7.24
3.80	2.45	0.769	1.681		0.235	7.5	0.761	7.74
3.70	2.43	0.755	1.675		0.255	8.7	0.746	8.96
3.69	2.45	0.753	1.697		0.265	8.5	0.744	8.77
3.68	2.50	0.753	1.747		0.280	9.4	0.743	9.68
3.67	2.55	0.752	1.798		0.285	9.5	0.742	9.79
3.66	2.60	0.749	1.851		0.315	9.0	0.740	9.32
3.65	2.65	0.748	1.902		0.330	8.5	0.739	8.83
3.64	2.70	0.745	1.955		0.345	8.0	0.737	8.34
3.63	2.73	0.743	1.987		0.360	7.5	0.736	7.86
3.62	2.75	0.740	2.010		0.375	6.1	0.734	6.48
3.61	2.75	0.739	2.011		0.390	5.2	0.733	5.59
3.60	2.73	0.736	1.994		0.400	5.0	0.731	5.4
3.59	2.71	0.735	1.975		0.405	5.2	0.729	5.61
3.58	2.66	0.733	1.927		0.410	5.5	0.727	5.91
3.57	2.63	0.732	1.898		0.415	6.3	0.725	6.72
3.56	2.60	0.731	1.869		0.420	7.5	0.723	7.92
3.55	2.56	0.731	1.829		0.425	8.3	0.722	8.725
3.54	2.55	0.729	1.821		0.430	9.0	0.720	9.43
3.53	2.52	0.729	1.791		0.435	10.3	0.718	10.44
3.52	2.50	0.727	1.773		0.440	10.5	0.716	10.94
3.51	2.48	0.725	1.755		0.445	10.3	0.714	10.75
3.50	2.47	0.722	1.748		0.450	9.5	0.712	9.95
3.49	2.46	0.718	1.742		0.445	8.7	0.709	9.15
3.48	2.45	0.716	1.734		0.440	8.2	0.707	8.64

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\alpha}$ (mb)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	σ_{in} (barns)	σ_{ab} (mb)
3.47	2.45	0.713	1.737	0.0	0.435	7.7	0.705	8.13
3.46	2.45	0.710	1.740		0.430	7.0	0.703	7.43
3.45	2.46	0.708	1.752		0.425	6.6	0.701	7.02
3.44	2.47	0.705	1.765		0.420	6.2	0.698	6.62
3.43	2.50	0.702	1.798		0.415	5.7	0.696	6.12
3.42	2.53	0.700	1.830		0.410	5.2	0.694	5.61
3.41	2.56	0.696	1.864		0.405	5.0	0.691	5.41
3.40	2.61	0.694	1.916		0.400	4.6	0.689	5.00
3.39	2.65	0.691	1.959		0.390	4.5	0.686	4.89
3.38	2.68	0.688	1.992		0.375	4.3	0.683	4.68
3.37	2.68	0.685	1.995		0.360	4.1	0.681	4.46
3.36	2.65	0.682	1.968		0.345	4.0	0.678	4.35
3.35	2.57	0.679	1.891		0.330	3.9	0.675	4.23
3.34	2.50	0.676	1.824		0.315	3.7	0.672	4.02
3.33	2.43	0.672	1.758		0.300	3.5	0.668	3.8
3.32	2.40	0.669	1.731		0.285	3.4	0.665	3.69
3.31	2.42	0.666	1.754		0.270	3.3	0.662	3.57
3.30	2.47	0.662	1.808		0.260	3.2	0.659	3.80
3.29	2.51	0.658	1.852		0.264	3.1	0.655	3.36
3.28	2.52	0.655	1.865		0.268	3.0	0.652	3.27
3.27	2.53	0.651	1.879		0.272	2.9	0.648	3.17
3.26	2.52	0.648	1.872		0.276	2.8	0.645	3.08
3.25	2.51	0.644	1.866		0.280	2.75	0.641	3.03
3.24	2.51	0.640	1.870		0.284	2.7	0.637	2.98
3.23	2.50	0.637	1.863		0.288	2.65	0.634	2.94
3.22	2.49	0.633	1.857		0.292	2.6	0.630	2.89
3.21	2.47	0.629	1.841		0.296	2.6	0.626	2.90
3.20	2.45	0.625	1.825		0.300	2.54	0.622	2.84
3.19	2.44	0.622	1.818		0.306	2.48	0.619	2.79
3.18	2.41	0.618	1.792		0.312	2.42	0.615	2.73
3.17	2.40	0.615	1.785		0.318	2.36	0.612	2.68
3.16	2.40	0.611	1.789		0.324	2.3	0.608	2.62
3.15	2.40	0.607	1.793		0.330	2.24	0.604	2.57
3.14	2.40	0.604	1.796		0.324	2.18	0.601	2.50
3.12	2.41	0.596	1.814		0.318	2.12	0.594	2.44
3.11	2.42	0.572	1.848		0.312	2.06	0.590	2.31

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\alpha}$ (mb)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	σ_{in} (barns)	σ_{ab} (mb)
3.10	2.43	0.589	1.841	0.0	0.300	2.0	0.587	2.30
3.09	2.45	0.585	1.865		0.293	1.95	0.583	2.24
3.08	2.47	0.581	1.889		0.286	1.9	0.579	2.18
3.07	2.48	0.578	1.902		0.279	1.85	0.576	2.13
3.06	2.51	0.574	1.936		0.272	1.8	0.572	2.07
3.05	2.54	0.570	1.97		0.265	1.75	0.568	1.96
3.04	2.56	0.567	1.993		0.265	1.7	0.565	1.97
3.03	2.57	0.563	2.007		0.265	1.65	0.561	1.92
3.02	2.60	0.539	2.061		0.265	1.6	0.557	1.87
3.01	2.62	0.556	2.064		0.265	1.55	0.554	1.82
3.00	2.64	0.552	2.088		0.265	1.5	0.550	1.77
2.99	2.65	0.548	2.102		0.267	1.49	0.546	1.76
2.98	2.66	0.543	2.117		0.269	1.47	0.541	1.74
2.97	2.67	0.539	2.131		0.271	1.45	0.537	1.72
2.96	2.67	0.534	2.136		0.273	1.42	0.532	1.69
2.95	2.67	0.530	2.14		0.275	1.40	0.528	1.68
2.94	2.66	0.525	2.135		0.276	1.36	0.523	1.64
2.93	2.65	0.521	2.129		0.277	1.32	0.519	1.60
2.92	2.63	0.516	2.114		0.278	1.28	0.514	1.56
2.91	2.59	0.511	2.079		0.279	1.24	0.509	1.52
2.90	2.56	0.505	2.055		0.280	1.2	0.504	1.48
2.89	2.52	0.500	2.02		0.281	1.16	0.499	1.44
2.88	2.47	0.495	1.975		0.282	1.12	0.494	1.40
2.87	2.44	0.490	1.95		0.285	1.12	0.489	1.41
2.86	2.44	0.485	1.955		0.287	1.12	0.484	1.41
2.85	2.45	0.480	1.97		0.310	1.12	0.479	1.43
2.84	2.46	0.475	1.985		0.312	1.12	0.474	1.43
2.83	2.52	0.469	2.051		0.314	1.12	0.468	1.43
2.82	2.65	0.464	2.186		0.316	1.11	0.463	1.43
2.81	2.8	0.459	2.341		0.318	1.11	0.458	1.43
2.80	2.9	0.453	2.447		0.320	1.11	0.452	1.43
2.79	2.9	0.447	2.453		0.325	1.11	0.446	1.44
2.78	2.96	0.440	2.52		0.330	1.11	0.439	1.44
2.77	2.97	0.433	2.537		0.335	1.11	0.432	1.45

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	σ_{in} (barns)	σ_{ab} (mb)
2.76	2.94	0.426	2.514	0.340	1.10	0.425	1.44
2.75	2.90	0.419	2.481	0.350	1.10	0.418	1.45
2.74	2.87	0.412	2.458	0.360	1.10	0.411	1.46
2.73	2.85	0.405	2.445	0.370	1.10	0.404	1.47
2.72	2.80	0.397	2.403	0.380	1.10	0.396	1.48
2.71	2.77	0.400	2.37	0.390	1.10	0.389	1.49
2.70	2.75	0.382	2.368	0.400	1.0	0.381	1.4
2.69	2.74	0.374	2.366	0.405	0.98	0.373	1.39
2.68	2.75	0.366	2.384	0.410	0.96	0.365	1.37
2.67	2.77	0.358	2.412	0.415	0.94	0.357	1.36
2.66	2.81	0.349	2.461	0.417	0.92	0.348	1.34
2.65	2.86	0.341	2.519	0.420	0.9	0.340	1.32
2.64	2.92	0.332	2.588	0.425	0.88	0.331	1.31
2.63	3.0	0.323	2.677	0.430	0.86	0.322	1.29
2.62	3.10	0.314	2.786	0.435	0.84	0.313	1.28
2.61	3.20	0.305	2.895	0.440	0.82	0.304	1.26
2.60	3.25	0.296	2.954	0.444	0.80	0.295	1.24
2.59	3.3	0.290	3.010	0.448	0.78	0.289	1.23
2.58	3.46	0.285	3.175	0.452	0.76	0.284	1.21
2.56	3.62	0.275	3.345	0.456	0.74	0.274	1.20
2.55	3.65	0.270	3.380	0.46	0.72	0.269	1.18
2.54	3.63	0.265	3.365	0.464	0.7	0.264	1.16
2.53	3.60	0.261	3.339	0.468	0.68	0.260	1.15
2.52	3.47	0.257	3.213	0.472	0.66	0.256	1.13
2.51	3.30	0.253	3.047	0.476	0.64	0.252	1.12
2.50	3.05	0.249	2.801	0.48	0.62	0.248	1.10
2.49	2.8	0.245	2.555	0.46	0.60	0.244	1.12
2.48	2.6	0.242	2.358	0.45	0.58	0.241	1.03
2.47	2.8	0.239	2.561	0.44	0.56	0.238	1.00
2.46	2.7	0.236	2.464	0.43	0.54	0.235	0.97
2.45	2.6	0.233	2.367	0.42	0.52	0.232	0.94
2.44	2.57	0.231	2.339	0.41	0.50	0.230	0.91
2.43	2.55	0.229	2.321	0.40	0.48	0.228	0.98
2.42	2.53	0.227	2.303	0.39	0.46	0.226	0.85

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{non} (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)	$\sigma_{n,p}$ (mb)	σ_{in} (barns)	σ_{ab} (mb)
2.41	2.52	0.225	2.295	0.37	0.44	0.224	0.81
2.40	2.50	0.223	2.277	0.35	0.42	0.222	0.77
2.35	2.80	0.234	2.566	0.33	0.38	0.233	0.71
2.30	3.00	0.257	2.743	0.32	0.34	0.256	0.66
2.25	3.10	0.292	2.808	0.31	0.30	0.291	0.61
2.20	3.30	0.338	2.962	0.30	0.28	0.337	0.58
2.15	3.20	0.348	2.852	0.37	0.25	0.347	0.62
2.10	3.20	0.351	2.849	0.44	0.20	0.350	0.62
2.00	3.40	0.311	3.089	0.52	0.16	0.310	0.68
1.95	3.20	0.297	2.90	0.43	0.10	0.296	0.53
1.90	2.70	0.286	2.41	0.36	0.00	0.286	0.36
1.85	2.35	0.281	2.07	0.29		0.281	0.29
1.80	2.75	0.283	2.47	0.36		0.283	$\sigma_{n,\gamma}$
1.75	3.55	0.292	3.26	0.42		0.292	
1.72	3.20	0.300	2.90	0.44		0.300	
1.70	3.00	0.302	2.70	0.45		0.302	
1.65	2.60	0.304	2.30	0.35		0.304	
1.60	3.00	0.30426	2.696	0.26		0.304	
1.55	3.35	0.301	3.049	0.265		0.301	
1.50	2.80	0.295	2.505	0.420		0.295	
1.45	3.30	0.269	3.031	0.460		0.269	
1.40	3.00	0.284	2.716	0.450		0.284	
1.35	2.65	0.280	2.370	0.420		0.280	
1.30	2.95	0.274	2.676	0.310		0.274	
1.25	3.50	0.268	3.232	0.320		0.268	
1.20	4.40	0.262	4.138	0.420		0.262	
1.15	3.40	0.255	3.145	0.480		0.255	
1.10	2.70	0.198	2.502	0.430		0.198	
1.00	2.60	0.007	2.593	0.300		0.007	
0.95	2.75	$\sigma_{n,\gamma}$	2.750	0.310		0.00	
0.90	3.08		3.080	0.450			
0.85	4.20		4.199	0.600			
0.82	6.40		6.399	0.630			
0.81	5.50		5.499	0.660			

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (MeV)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
0.80	5.20	5.199	0.690
0.775	4.30	4.399	0.600
0.750	3.20	3.199	0.590
0.720	3.30	3.300	0.490
0.710	4.00	4.000	0.490
0.700	3.30	3.300	0.490
0.680	3.00	2.999	0.51
0.670	3.10	3.099	0.53
0.660	3.90	3.899	0.55
0.650	5.20	5.199	0.59
0.640	4.00	3.999	0.62
0.630	3.20	3.199	0.67
0.625	4.20	4.199	0.69
0.620	3.00	2.999	0.72
0.610	2.50	2.499	0.78
0.600	2.65	2.649	0.840
0.590	4.00	3.999	0.840
0.580	4.80	4.799	0.840
0.570	3.70	3.699	0.820
0.560	3.50	3.499	0.800
0.550	4.50	4.499	0.780
0.540	5.00	4.999	0.750
0.530	3.40	3.399	0.700
0.520	3.50	3.499	0.600
0.510	3.70	3.700	0.400
0.500	3.20	3.199	0.600
0.490	3.20	3.199	1.10
0.480	3.25	3.248	0.90
0.470	3.52	3.519	1.20
0.460	4.10	4.100	0.40
0.450	4.30	4.299	0.60
0.440	5.20	5.199	1.00
0.437	4.50	4.498	2.30

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (keV)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
435	6.20	6.198	2.30
432	5.50	5.498	2.30
430	3.90	3.898	2.30
425	5.30	5.298	2.30
420	6.00	5.998	2.30
415	5.50	5.498	1.50
410	3.70	3.699	1.00
400	3.10	3.099	0.89
396	3.40	3.399	0.90
392	3.50	3.499	0.80
388	4.00	3.999	0.75
384	2.20	2.199	0.65
380	2.30	2.299	0.55
376	3.50	3.499	0.50
372	5.00	5.000	0.45
368	7.00	7.000	0.40
364	4.50	4.500	0.37
360	3.50	3.500	0.35
356	3.00	3.000	0.35
352	2.60	2.600	0.36
348	2.90	2.900	0.39
344	3.00	3.000	0.44
340	3.30	3.300	0.50
336	3.20	3.199	0.72
332	3.10	3.099	1.00
328	3.30	3.299	1.14
324	3.50	3.499	1.21
320	4.00	3.999	1.20
316	4.50	4.499	1.21
312	5.80	5.799	1.20
308	4.20	4.199	1.16
304	4.40	4.399	1.09
300	4.70	4.699	1.00
296	5.20	5.199	1.17
294	5.60	5.599	1.27

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (keV)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
292	6.00	5.999	1.40
288	5.80	5.798	1.64
284	5.60	5.598	1.91
280	5.20	5.198	2.21
276	3.80	3.797	2.54
274	2.10	2.097	2.72
272	2.10	2.097	2.90
268	2.10	2.098	2.43
264	2.10	2.098	1.69
260	2.60	2.599	0.70
256	4.00	3.999	0.70
252	2.30	2.299	0.70
248	2.80	2.799	0.77
244	3.00	2.999	0.90
240	3.30	2.299	1.10
236	3.40	3.399	1.37
232	3.60	3.598	1.70
228	4.00	3.998	2.10
224	4.5	4.498	1.82
220	3.7	3.699	1.40
216	2.6	2.598	1.46
212	4.1	4.098	1.79
208	6.2	6.198	2.40
204	6.4	6.398	1.87
200	5.2	5.199	0.90
195	3.0	2.999	0.90
190	2.9	2.899	0.85
185	3.1	3.099	0.93
180	3.3	2.299	1.16
175	4.0	3.998	1.51
170	4.5	4.498	2.00
165	5.7	5.697	3.00
164	6.0	5.997	3.17
163	6.8	6.797	3.33
162	7.8	7.797	3.48

Table 3 (Cont.)

NEUTRON CROSS SECTIONS OF ALUMINUM

<u>E</u> (keV)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
161	9.4	9.396	3.62
160	10.0	9.996	3.75
159	14.0	13.996	3.87
158	12.0	11.996	3.98
157	11.0	10.996	4.08
156	9.4	9.396	4.17
155	8.5	8.496	4.25
153	7.9	7.896	4.38
152	9.0	8.996	4.43
150	10.0	9.996	4.50
148	10.5	10.496	4.44
146	10.7	10.696	4.32
144	10.5	10.496	4.14
142	9.8	9.796	3.90
140	8.0	7.996	3.60
138	5.0	4.996	3.78
136	3.5	3.496	4.08
134	2.4	2.396	4.50
132	1.5	1.495	4.76
130	1.3	1.295	5.00
128	1.3	1.295	5.22
126	1.6	1.595	5.42
124	2.1	2.094	5.60
122	4.0	3.994	5.65
120	11.0	10.994	5.63
118	4.0	3.994	5.56
116	2.5	2.495	5.43
114	2.3	2.295	5.25
112	2.4	2.395	5.00
110	2.5	2.495	4.70
108	2.6	2.596	4.50
106	2.8	2.796	4.28
104	3.4	3.396	4.04
102	3.9	3.896	3.78
100	4.8	4.796	3.50

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (keV)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
95	8.3	8.297	2.98
90	16.0	15.998	2.50
88	18.0	17.998	2.32
86	16.0	15.998	2.16
85	15.0	14.998	1.95
80	5.0	4.998	1.80
75	2.2	2.198	1.85
70	1.5	1.498	2.00
65	1.4	1.398	2.20
60	1.5	1.498	2.50
55	1.8	1.797	3.00
50	2.2	2.196	4.00
45	3.2	3.192	8.00
40	6.4	6.380	19.5
38	11.0	10.982	17.5
35	35.0	34.986	13.5
34	22.0	21.989	11.0
33	10.0	9.990	10.0
31	2.5	2.495	5.0
30	1.5	1.497	3.0
29	1.0	0.998	2.5
28	0.8	0.798	2.3
26	0.5	0.498	2.2
25	0.48	0.478	2.15
24	0.5	0.498	2.15
22	0.52	0.518	2.15
20	0.66	0.658	2.20
17.5	0.8	0.798	2.35
15.0	0.94	0.937	2.60
13.0	1.01	1.007	3.00
10.0	1.1	1.096	4.00
8.0	1.15	1.15	5.70
7.0	1.2	1.20	4.91
6.4	1.25		

Table 3 (Cont.)
NEUTRON CROSS SECTIONS OF ALUMINUM

E (kev)	σ_T (barns)	σ_{el} (barns)	$\sigma_{n,\gamma}$ (mb)
6.2	1.4	1.4	9.70
6.1	1.5	1.5	9.75
6.0	5.0	5.0	9.80
5.9	50.2	50.2	10.00
5.85	15.0	15.0	9.80
5.80	3.0	3.0	9.60
5.70	1.45	1.45	8.80
5.00	1.41	1.41	5.50
4.50	1.41	1.41	3.50
4.00	1.41	1.41	2.40
3.00	1.41	1.41	1.5
2.00	1.41	1.41	0.94
1.50	1.41	1.41	0.96
↓	↓	↓	$\frac{1}{v}$ ↓

Table 4

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f_1	f_2	f_3	f_4	f_5	f_6	f_7
15.	0.71	0.57	0.442	0.35	0.30	0.23	0.130
14.5	0.70	0.56	0.440	0.335	0.280	0.22	0.120
14.	0.693	0.553	0.435	0.330	0.265	0.205	0.105
13.5	0.68	0.545	0.425	0.315	0.252	0.190	0.092
13.0	0.675	0.535	0.422	0.302	0.242	0.180	0.083
12.5	0.665	0.525	0.415	0.290	0.230	0.162	0.070
12.0	0.655	0.515	0.405	0.280	0.219	0.150	0.060
11.5	0.645	0.505	0.400	0.270	0.202	0.135	0.050
11.0	0.635	0.495	0.390	0.260	0.190	0.120	0.035
10.5	0.625	0.485	0.380	0.245	0.175	0.102	0.021
10.0	0.615	0.470	0.368	0.230	0.162	0.090	0.005
9.8	0.610	0.465	0.365	0.225	0.160	0.082	0.0
9.7	0.607	0.462	0.362	0.221	0.155	0.080	
9.6	0.605	0.460	0.360	0.220	0.152	0.078	
9.5	0.602	0.458	0.358	0.218	0.150	0.073	
9.4	0.600	0.455	0.355	0.215	0.148	0.070	
9.3	0.599	0.452	0.352	0.208	0.141	0.065	
9.2	0.598	0.450	0.350	0.207	0.140	0.062	
9.1	0.595	0.445	0.349	0.204	0.138	0.060	
9.0	0.592	0.442	0.348	0.200	0.135	0.058	
8.9	0.590	0.440	0.345	0.198	0.132	0.052	
8.8	0.588	0.439	0.342	0.195	0.130	0.050	
8.7	0.584	0.435	0.340	0.193	0.125	0.047	
8.6	0.582	0.430	0.338	0.190	0.122	0.045	
8.5	0.580	0.428	0.335	0.185	0.121	0.040	
8.4	0.578	0.425	0.332	0.182	0.120	0.038	
8.3	0.575	0.422	0.330	0.180	0.118	0.035	
8.2	0.572	0.420	0.328	0.179	0.115	0.030	
8.1	0.570	0.415	0.322	0.175	0.110	0.025	
8.0	0.568	0.410	0.320	0.170	0.108	0.022	

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
7.9	0.565	0.405	0.317	0.168	0.105	0.020	0.0
7.8	0.561	0.402	0.315	0.165	0.102	0.018	
7.7	0.560	0.400	0.310	0.160	0.101	0.015	
7.6	0.558	0.398	0.305	0.159	0.100	0.010	
7.5	0.555	0.395	0.300	0.155	0.095	0.007	
7.4	0.552	0.392	0.297	0.152	0.092	0.005	
7.3	0.550	0.390	0.292	0.150	0.090	0.001	
7.2	0.545	0.388	0.285	0.148	0.088	0.0	
7.1	0.542	0.385	0.282	0.142	0.085		
7.0	0.540	0.380	0.275	0.140	0.080		
6.9	0.539	0.378	0.270	0.135	0.080		
6.8	0.538	0.375	0.265	0.130	0.079		
6.7	0.530	0.370	0.260	0.125	0.075		
6.6	0.528	0.365	0.255	0.121	0.070		
6.5	0.525	0.362	0.245	0.120	0.068		
6.4	0.522	0.360	0.238	0.115	0.065		
6.3	0.520	0.355	0.230	0.110	0.063		
6.2	0.516	0.352	0.225	0.105	0.060		
6.1	0.512	0.348	0.219	0.102	0.059		
6.0	0.509	0.345	0.210	0.100	0.055		
5.9	0.505	0.339	0.205	0.093	0.052		
5.8	0.502	0.335	0.202	0.090	0.050		
5.7	0.500	0.330	0.198	0.085	0.047		
5.6	0.498	0.325	0.190	0.080	0.042		
5.5	0.495	0.315	0.185	0.078	0.041		
5.42	0.491	0.311	0.178	0.075	0.041		
5.4	0.490	0.310	0.175	0.072	0.040		
5.38	0.488	0.309	0.174	0.072	0.040		
5.36	0.487	0.309	0.173	0.071	0.039		
5.34	0.486	0.308	0.172	0.071	0.039		

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
5.32	0.485	0.307	0.171	0.070	0.038	0.0	0.0
5.30	0.484	0.306	0.170	0.070	0.038		
5.24	0.483	0.304	0.164	0.069	0.035		
5.20	0.482	0.302	0.162	0.068	0.032		
5.10	0.480	0.300	0.155	0.065	0.030		
5.00	0.478	0.295	0.150	0.060	0.025		
4.9	0.475	0.290	0.139	0.055	0.024		
4.8	0.470	0.285	0.130	0.050	0.020		
4.75	0.468	0.283	0.122	0.049	0.019		
4.7	0.465	0.282	0.120	0.048	0.019		
4.64	0.462	0.280	0.118	0.045	0.015		
4.55	0.461	0.275	0.110	0.042	0.012		
4.5	0.459	0.270	0.105	0.041	0.010		
4.4	0.455	0.267	0.100	0.040	0.007		
4.3	0.450	0.261	0.099	0.039	0.003		
4.2	0.445	0.259	0.092	0.035	0.002		
4.1	0.442	0.252	0.085	0.032	0.001		
3.9	0.435	0.245	0.078	0.029	0.0		
3.8	0.430	0.240	0.073	0.028			
3.7	0.422	0.235	0.071	0.025			
3.69	0.422	0.235	0.071	0.025			
3.68	0.422	0.234	0.071	0.024			
3.67	0.422	0.233	0.071	0.024			
3.66	0.422	0.233	0.070	0.023			
3.65	0.421	0.232	0.070	0.023			
3.64	0.421	0.232	0.070	0.022			
3.63	0.421	0.231	0.070	0.022			
3.62	0.421	0.231	0.069	0.022			
3.61	0.420	0.230	0.069	0.022			
3.60	0.420	0.230	0.069	0.022			
3.59	0.420	0.229	0.069	0.021			

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
3.58	0.420	0.228	0.068	0.021	0.0	0.0	0.0
3.57	0.420	0.228	0.068	0.021			
3.56	0.419	0.227	0.068	0.021			
3.55	0.419	0.227	0.068	0.021			
3.54	0.417	0.226	0.067	0.021			
3.53	0.417	0.225	0.067	0.021			
3.52	0.416	0.224	0.066	0.021			
3.51	0.416	0.223	0.066	0.021			
3.50	0.415	0.222	0.065	0.020			
3.49	0.415	0.222	0.065	0.020			
3.48	0.414	0.221	0.064	0.020			
3.47	0.414	0.221	0.064	0.020			
3.46	0.413	0.220	0.063	0.020			
3.45	0.413	0.220	0.063	0.020			
3.44	0.412	0.220	0.063	0.020			
3.43	0.412	0.219	0.063	0.020			
3.42	0.411	0.219	0.062	0.019			
3.41	0.411	0.218	0.062	0.019			
3.40	0.410	0.218	0.062	0.019			
3.39	0.409	0.217	0.062	0.019			
3.38	0.409	0.217	0.062	0.019			
3.37	0.408	0.216	0.062	0.019			
3.36	0.408	0.216	0.062	0.019			
3.35	0.407	0.215	0.062	0.019			
3.34	0.407	0.215	0.061	0.018			
3.33	0.406	0.214	0.061	0.018			
3.32	0.406	0.213	0.061	0.018			
3.31	0.405	0.212	0.061	0.018			
3.30	0.405	0.212	0.061	0.018			
3.29	0.404	0.211	0.061	0.018			
3.28	0.404	0.211	0.061	0.018			

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f_1	f_2	f_3	f_4	f_5	f_6	f_7
3.27	0.403	0.211	0.061	0.018	0.0	0.0	0.0
3.26	0.403	0.210	0.061	0.018			
3.25	0.402	0.210	0.060	0.018			
3.24	0.402	0.209	0.060	0.018			
3.23	0.401	0.209	0.060	0.018			
3.22	0.401	0.209	0.060	0.018			
3.21	0.400	0.209	0.060	0.018			
3.2	0.400	0.209	0.060	0.017			
3.19	0.400	0.208	0.060	0.017			
3.18	0.399	0.208	0.060	0.017			
3.17	0.399	0.207	0.060	0.017			
3.16	0.399	0.206	0.060	0.017			
3.15	0.399	0.205	0.059	0.017			
3.14	0.399	0.205	0.059	0.016			
3.13	0.398	0.204	0.059	0.016			
3.12	0.398	0.203	0.059	0.016			
3.11	0.398	0.202	0.059	0.016			
3.10	0.398	0.201	0.059	0.016			
3.09	0.397	0.201	0.059	0.015			
3.08	0.397	0.201	0.059	0.015			
3.07	0.396	0.200	0.059	0.015			
3.06	0.396	0.200	0.059	0.015			
3.05	0.395	0.200	0.059	0.015			
3.04	0.394	0.200	0.058	0.015			
3.03	0.393	0.199	0.058	0.015			
3.02	0.392	0.199	0.058	0.015			
3.01	0.391	0.199	0.058	0.015			
3.00	0.390	0.198	0.058	0.015			
2.99	0.390	0.197	0.057	0.014			
2.98	0.390	0.196	0.056	0.014			
2.97	0.389	0.195	0.055	0.013			

Table 4 (Cont.)
LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
2.96	0.389	0.194	0.055	0.013	0.0	0.0	0.0
2.95	0.388	0.193	0.055	0.012			
2.94	0.387	0.193	0.055	0.012			
2.93	0.387	0.192	0.055	0.012			
2.92	0.386	0.191	0.055	0.012			
2.91	0.385	0.191	0.055	0.011			
2.90	0.385	0.190	0.055	0.011			
2.89	0.384	0.190	0.054	0.011			
2.88	0.384	0.189	0.054	0.011			
2.87	0.383	0.189	0.054	0.011			
2.86	0.383	0.188	0.054	0.011			
2.85	0.383	0.188	0.053	0.010			
2.84	0.382	0.187	0.053	0.010			
2.83	0.382	0.187	0.053	0.010			
2.82	0.381	0.186	0.053	0.010			
2.81	0.381	0.186	0.052	0.010			
2.80	0.380	0.185	0.052	0.010			
2.79	0.380	0.184	0.051	0.010			
2.78	0.380	0.183	0.051	0.010			
2.77	0.379	0.183	0.050	0.010			
2.76	0.379	0.182	0.049	0.010			
2.75	0.379	0.182	0.048	0.010			
2.74	0.378	0.182	0.048	0.009			
2.73	0.377	0.181	0.048	0.009			
2.72	0.377	0.181	0.048	0.009			
2.71	0.376	0.181	0.049	0.009			
2.70	0.375	0.181	0.049	0.009			
2.69	0.375	0.180	0.049	0.009			
2.68	0.374	0.180	0.048	0.008			
2.67	0.374	0.180	0.048	0.008			
2.66	0.373	0.179	0.048	0.008			

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
2.65	0.373	0.179	0.047	0.008	0.0	0.0	0.0
2.64	0.372	0.178	0.047	0.008			
2.63	0.371	0.178	0.046	0.007			
2.62	0.371	0.177	0.046	0.007			
2.61	0.370	0.176	0.045	0.007			
2.60	0.369	0.175	0.045	0.007			
2.59	0.369	0.175	0.045	0.007			
2.58	0.368	0.174	0.044	0.006			
2.57	0.367	0.174	0.044	0.006			
2.56	0.366	0.173	0.044	0.006			
2.55	0.365	0.173	0.043	0.006			
2.54	0.365	0.173	0.043	0.006			
2.53	0.364	0.172	0.043	0.005			
2.52	0.364	0.172	0.042	0.005			
2.51	0.363	0.170	0.042	0.005			
2.50	0.362	0.170	0.042	0.005			
2.49	0.362	0.169	0.042	0.005			
2.48	0.361	0.168	0.041	0.004			
2.47	0.361	0.168	0.041	0.004			
2.46	0.360	0.167	0.041	0.004			
2.45	0.360	0.167	0.041	0.003			
2.44	0.360	0.167	0.040	0.003			
2.43	0.359	0.166	0.040	0.003			
2.42	0.359	0.166	0.040	0.002			
2.41	0.358	0.165	0.040	0.002			
2.40	0.358	0.165	0.040	0.002			
2.35	0.354	0.162	0.039	0.001			
2.30	0.350	0.160	0.039	0.0			
2.25	0.347	0.158	0.038				
2.20	0.342	0.155	0.038				
2.15	0.340	0.153	0.037				

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
2.10	0.339	0.151	0.036	0.0	0.0	0.0	0.0
2.00	0.330	0.145	0.035				
1.95	0.325	0.142	0.033				
1.90	0.322	0.140	0.032				
1.85	0.320	0.135	0.031				
1.80	0.318	0.133	0.031				
1.75	0.312	0.130	0.031				
1.72	0.310	0.129	0.030				
1.70	0.309	0.128	0.030				
1.65	0.303	0.124	0.029				
1.60	0.299	0.120	0.029				
1.55	0.295	0.118	0.028				
1.50	0.289	0.115	0.028				
1.45	0.285	0.110	0.027				
1.40	0.279	0.107	0.025				
1.35	0.272	0.102	0.023				
1.30	0.265	0.100	0.023				
1.25	0.260	0.095	0.022				
1.20	0.255	0.092	0.022				
1.15	0.250	0.085	0.021				
1.10	0.242	0.082	0.021				
1.00	0.230	0.079	0.020				
0.95	0.220	0.073	0.019				
0.90	0.215	0.070	0.018				
0.85	0.209	0.065	0.017				
0.82	0.203	0.063	0.017				
0.81	0.202	0.062	0.016				
0.80	0.201	0.062	0.016				
0.775	0.198	0.060	0.015				
0.750	0.195	0.059	0.014				
0.720	0.188	0.058	0.014				

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
0.710	0.187	0.056	0.013	0.0	0.0	0.0	0.0
0.700	0.185	0.055	0.012				
0.680	0.180	0.052	0.012				
0.670	0.179	0.052	0.011				
0.660	0.177	0.051	0.010				
0.650	0.175	0.050	0.010				
0.640	0.174	0.049	0.010				
0.630	0.172	0.049	0.010				
0.625	0.169	0.049	0.009				
0.620	0.168	0.048	0.009				
0.610	0.166	0.048	0.009				
0.600	0.162	0.048	0.009				
0.590	0.161	0.045	0.009				
0.580	0.160	0.043	0.008				
0.570	0.159	0.043	0.007				
0.560	0.158	0.042	0.006				
0.550	0.155	0.042	0.005				
0.540	0.150	0.041	0.004				
0.530	0.148	0.040	0.003				
0.520	0.143	0.040	0.002				
0.510	0.142	0.040	0.001				
0.500	0.140	0.040	0.0				
0.490	0.139	0.039					
0.480	0.138	0.038					
0.470	0.132	0.037					
0.460	0.129	0.036					
0.450	0.125	0.035					
0.440	0.122	0.034					
0.437	0.121	0.033					
0.435	0.120	0.032					
0.432	0.120	0.032					

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
0.430	0.119	0.032	0.0	0.0	0.0	0.0	0.0
0.425	0.118	0.031					
0.420	0.117	0.030					
0.415	0.115	0.030					
0.410	0.114	0.029					
0.40	0.112	0.029					
0.396	0.11	0.028					
0.392	0.108	0.028					
0.388	0.106	0.027					
0.384	0.104	0.027					
0.380	0.102	0.026					
0.376	0.100	0.026					
0.372	0.098	0.025					
0.368	0.096	0.025					
0.364	0.094	0.024					
0.360	0.092	0.023					
0.356	0.091	0.022					
0.352	0.091	0.022					
0.348	0.09	0.021					
0.344	0.088	0.021					
0.340	0.086	0.020					
0.336	0.085	0.020					
0.332	0.084	0.019					
0.328	0.082	0.019					
0.324	0.08	0.018					
0.320	0.078	0.018					
0.316	0.076	0.017					
0.312	0.075	0.017					
0.308	0.074	0.016					
0.304	0.072	0.016					
0.300	0.07	0.015					

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
0.296	0.069	0.015	0.0	0.0	0.0	0.0	0.0
0.294	0.068	0.014					
0.292	0.066	0.014					
0.288	0.065	0.013					
0.284	0.064	0.012					
0.280	0.062	0.012					
0.276	0.061	0.011					
0.274	0.06	0.011					
0.272	0.058	0.010					
0.268	0.056	0.010					
0.264	0.054	0.009					
0.260	0.052	0.009					
0.256	0.05	0.008					
0.252	0.048	0.008					
0.248	0.046	0.007					
0.244	0.044	0.007					
0.240	0.042	0.006					
0.236	0.040	0.006					
0.232	0.036	0.005					
0.228	0.032	0.005					
0.224	0.03	0.004					
0.220	0.028	0.004					
0.216	0.024	0.003					
0.212	0.020	0.003					
0.208	0.018	0.002					
0.204	0.017	0.001					
0.200	0.015	0.0					
0.195	0.014						
0.190	0.013						
0.185	0.012						
0.180	0.011						

Table 4 (Cont.)

LEGENDRE EXPANSION COEFFICIENTS FOR ELASTIC SCATTERING

E(MeV)	f ₁	f ₂	f ₃	f ₄	f ₅	f ₆	f ₇
0.175	0.010	0.0	0.0	0.0	0.0	0.0	0.0
0.170	0.009						
0.165	0.008						
0.164	0.007						
0.163	0.006						
0.162	0.005						
0.161	0.004						
0.160	0.003						
0.159	0.003						
0.158	0.002						
0.157	0.002						
0.156	0.001						
0.155	0.0						

Table 5
INELASTIC CROSS SECTIONS FOR ALUMINUM

<u>E</u>	<u>0.842</u>	<u>1.013</u>	<u>2.21</u>	<u>2.73</u>	<u>2.976</u>	<u>3.00</u>	<u>3.674</u>	<u>3.951</u>	<u>4.052</u>	<u>4.403</u>	<u>4.504</u>	<u>4.576</u>	<u>4.805</u>
5.00	0.052	0.105	0.150	0.105	0.061	0.143	0.021	0.084	0.039	0.040	0.031	0.029	0.001
4.90	0.053	0.107	0.156	0.108	0.062	0.150	0.022	0.084	0.039	0.032	0.021	0.015	0.0002
4.80	0.055	0.111	0.162	0.112	0.064	0.156	0.022	0.082	0.037	0.024	0.013	0.006	
4.75	0.056	0.112	0.164	0.113	0.065	0.158	0.022	0.080	0.036	0.019	0.009	0.002	
4.70	0.057	0.114	0.167	0.115	0.066	0.159	0.022	0.078	0.034	0.014	0.006	0.0009	
4.64	0.058	0.117	0.170	0.118	0.067	0.161	0.021	0.075	0.032	0.008	0.002		
4.55	0.060	0.120	0.175	0.121	0.069	0.163	0.020	0.067	0.027	0.001			
4.50	0.061	0.122	0.177	0.123	0.070	0.163	0.020	0.062	0.023				
4.40	0.062	0.126	0.181	0.126	0.071	0.165	0.020	0.049	0.015				
4.30	0.064	0.130	0.186	0.129	0.072	0.166	0.018	0.034	0.007				
4.20	0.066	0.135	0.192	0.134	0.074	0.167	0.016	0.017					
4.10	0.068	0.138	0.194	0.135	0.075	0.166	0.012	0.007					
3.90	0.069	0.142	0.196	0.135	0.074	0.158	0.004						
3.80	0.069	0.143	0.198	0.133	0.074	0.167	0.016	0.017					
3.70	0.069	0.144	0.199	0.130	0.075	0.165	0.020	0.049	0.015				
3.69	0.069	0.144	0.199	0.135	0.072	0.166	0.018	0.034	0.007				
3.68	0.069	0.144	0.199	0.130	0.068	0.150	0.017	0.016	0.017				
3.67	0.070	0.144	0.199	0.129	0.075	0.166	0.012	0.007					
3.66	0.070	0.144	0.200	0.129	0.062	0.156	0.017	0.017	0.017				
3.65	0.070	0.145	0.200	0.129	0.063	0.158	0.016	0.014	0.014				
3.64	0.070	0.145	0.200	0.129	0.061	0.133	0.013	0.013	0.013				
3.63	0.070	0.145	0.200	0.128	0.060	0.132	0.012	0.012	0.012				
3.62	0.070	0.145	0.200	0.128	0.060	0.131	0.011	0.011	0.011				
3.61	0.070	0.145	0.200	0.128	0.059	0.130	0.010	0.010	0.010				
3.60	0.070	0.146	0.201	0.128	0.059	0.129	0.009	0.009	0.009				
3.59	0.070	0.146	0.201	0.127	0.058	0.127	0.008	0.008	0.008				

Table 5 (Cont.)
INELASTIC CROSS SECTIONS FOR ALUMINUM

<u>E</u>	<u>0.842</u>	<u>1.013</u>	<u>2.21</u>	<u>2.73</u>	<u>2.976</u>	<u>3.00</u>	<u>3.674</u>	<u>3.951</u>	<u>4.052</u>	<u>4.403</u>	<u>4.504</u>	<u>4.576</u>	<u>4,805</u>
3.58	0.070	0.146	0.201	0.127	0.057	0.126							
3.57	0.070	0.146	0.202	0.126	0.057	0.124							
3.56	0.070	0.147	0.202	0.126	0.056	0.123							
3.55	0.070	0.147	0.202	0.125	0.055	0.121							
3.54	0.070	0.147	0.203	0.125	0.054	0.119							
3.53	0.071	0.147	0.203	0.125	0.053	0.118							
3.52	0.071	0.148	0.204	0.124	0.053	0.116							
3.51	0.071	0.148	0.204	0.124	0.052	0.114							
3.50	0.071	0.149	0.205	0.123	0.051	0.113							
3.49	0.071	0.149	0.205	0.123	0.050	0.111							
3.48	0.071	0.149	0.206	0.122	0.049	0.109							
3.47	0.071	0.150	0.206	0.122	0.048	0.107							
3.46	0.071	0.150	0.207	0.121	0.047	0.105							
3.45	0.071	0.150	0.207	0.120	0.046	0.104							
3.44	0.072	0.151	0.208	0.120	0.045	0.102							
3.43	0.072	0.151	0.209	0.119	0.043	0.100							
3.42	0.072	0.152	0.209	0.119	0.042	0.098							
3.41	0.072	0.152	0.210	0.118	0.041	0.096							
3.40	0.072	0.153	0.211	0.118	0.040	0.094							
3.39	0.072	0.153	0.211	0.117	0.039	0.092							
3.38	0.072	0.154	0.212	0.116	0.038	0.089							
3.37	0.072	0.154	0.213	0.115	0.036	0.087							
3.36	0.073	0.155	0.214	0.114	0.035	0.084							
3.35	0.073	0.156	0.214	0.113	0.034	0.081							
3.34	0.073	0.156	0.215	0.112	0.033	0.079							
3.33	0.073	0.157	0.216	0.111	0.031	0.076							

Table 5 (Cont.)

INELASTIC CROSS SECTIONS FOR ALUMINUM

<u>E</u>	<u>0.842</u>	<u>1.013</u>	<u>2.21</u>	<u>2.73</u>	<u>2.976</u>	<u>3.00</u>	<u>3.674</u>	<u>3.951</u>	<u>4.052</u>	<u>4.403</u>	<u>4.504</u>	<u>4.576</u>	<u>4.805</u>
3.32	0.074	0.158	0.217	0.110	0.030	0.074							
3.31	0.074	0.158	0.218	0.109	0.029	0.071							
3.30	0.074	0.159	0.219	0.108	0.027	0.068							
3.29	0.074	0.160	0.220	0.107	0.026	0.065							
3.28	0.075	0.161	0.221	0.106	0.025	0.062							
3.27	0.075	0.161	0.222	0.105	0.023	0.059							
3.26	0.075	0.162	0.223	0.104	0.022	0.056							
3.25	0.075	0.163	0.224	0.103	0.020	0.053							
3.24	0.076	0.164	0.225	0.102	0.019	0.050							
3.23	0.076	0.165	0.226	0.100	0.017	0.047							
3.22	0.076	0.166	0.227	0.099	0.016	0.044							
3.21	0.076	0.167	0.228	0.098	0.014	0.040							
3.20	0.077	0.168	0.230	0.097	0.013	0.037							
3.19	0.077	0.169	0.229	0.095	0.012	0.035							
3.18	0.078	0.170	0.229	0.094	0.011	0.032							
3.17	0.078	0.171	0.228	0.092	0.010	0.030							
3.16	0.079	0.173	0.227	0.091	0.009	0.028							
3.15	0.079	0.174	0.227	0.089	0.008	0.026							
3.14	0.080	0.176	0.226	0.087	0.008	0.024							
3.12	0.081	0.179	0.223	0.084	0.006	0.020							
3.11	0.081	0.180	0.222	0.082	0.005	0.018							
3.10	0.082	0.182	0.221	0.080	0.005	0.016							
3.09	0.083	0.183	0.219	0.079	0.004	0.014							
3.08	0.083	0.185	0.217	0.077	0.003	0.012							
3.07	0.084	0.187	0.216	0.076	0.003	0.011							
3.06	0.085	0.189	0.214	0.073	0.002	0.009							

Table 5 (Cont.)
INELASTIC CROSS SECTIONS FOR ALUMINUM

Table 5 (Cont.)

INELASTIC CROSS SECTIONS FOR ALUMINUM

Table 5 (Cont.)

INELASTIC CROSS SECTIONS FOR ALUMINUM

Table 5 (Cont.)

INELASTIC CROSS SECTIONS FOR ALUMINUM

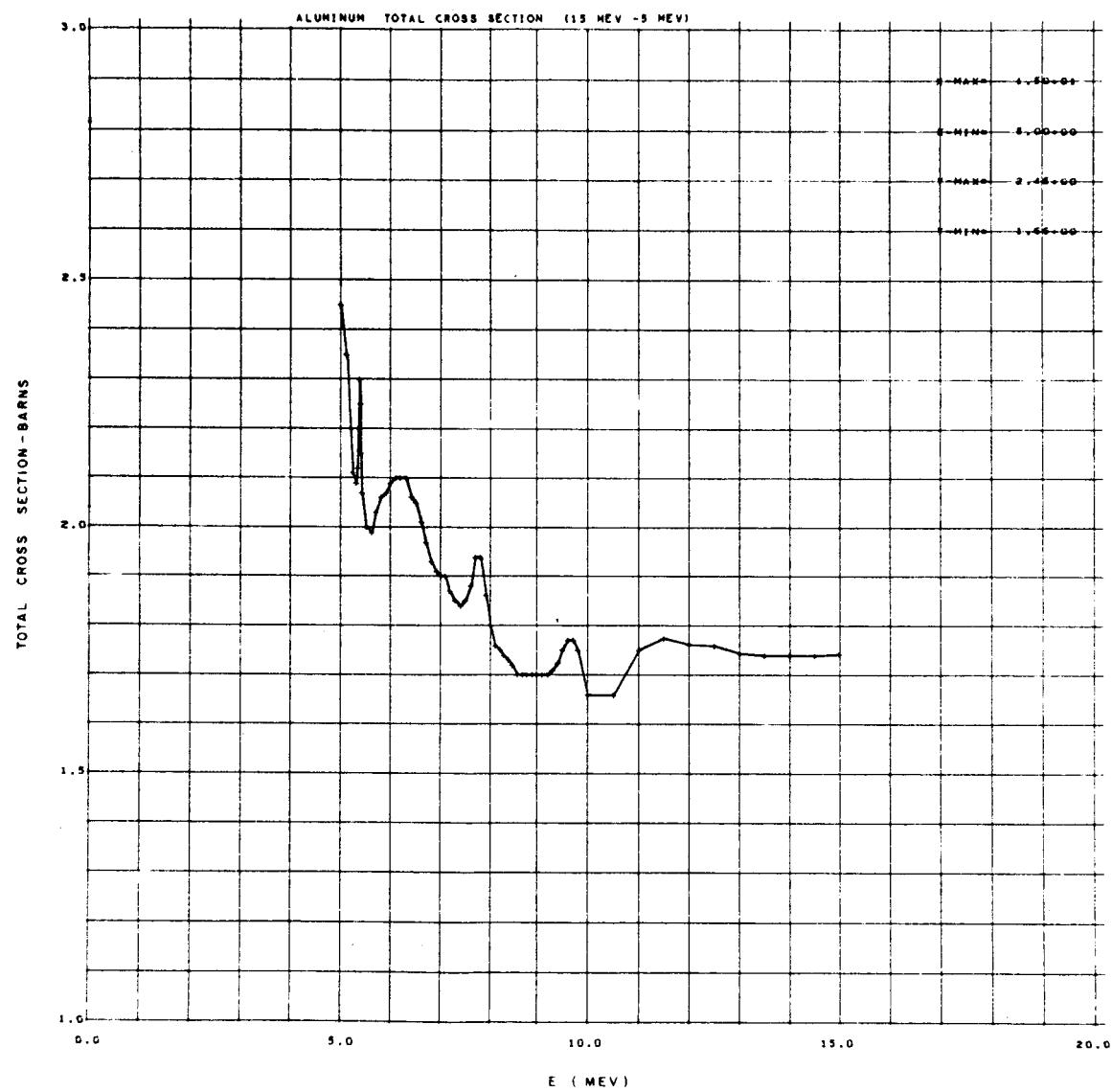


Fig. 1

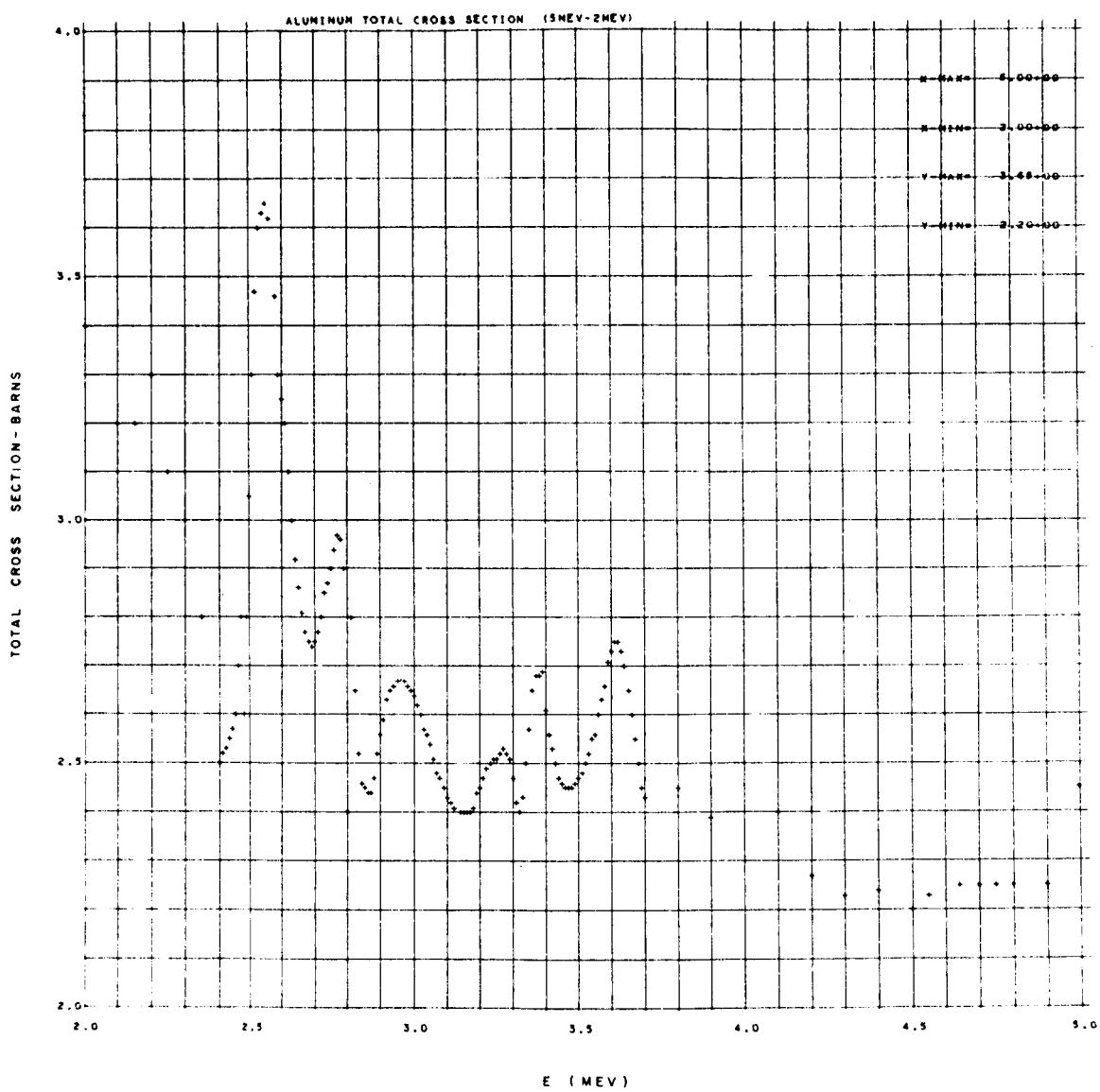


Fig. 2

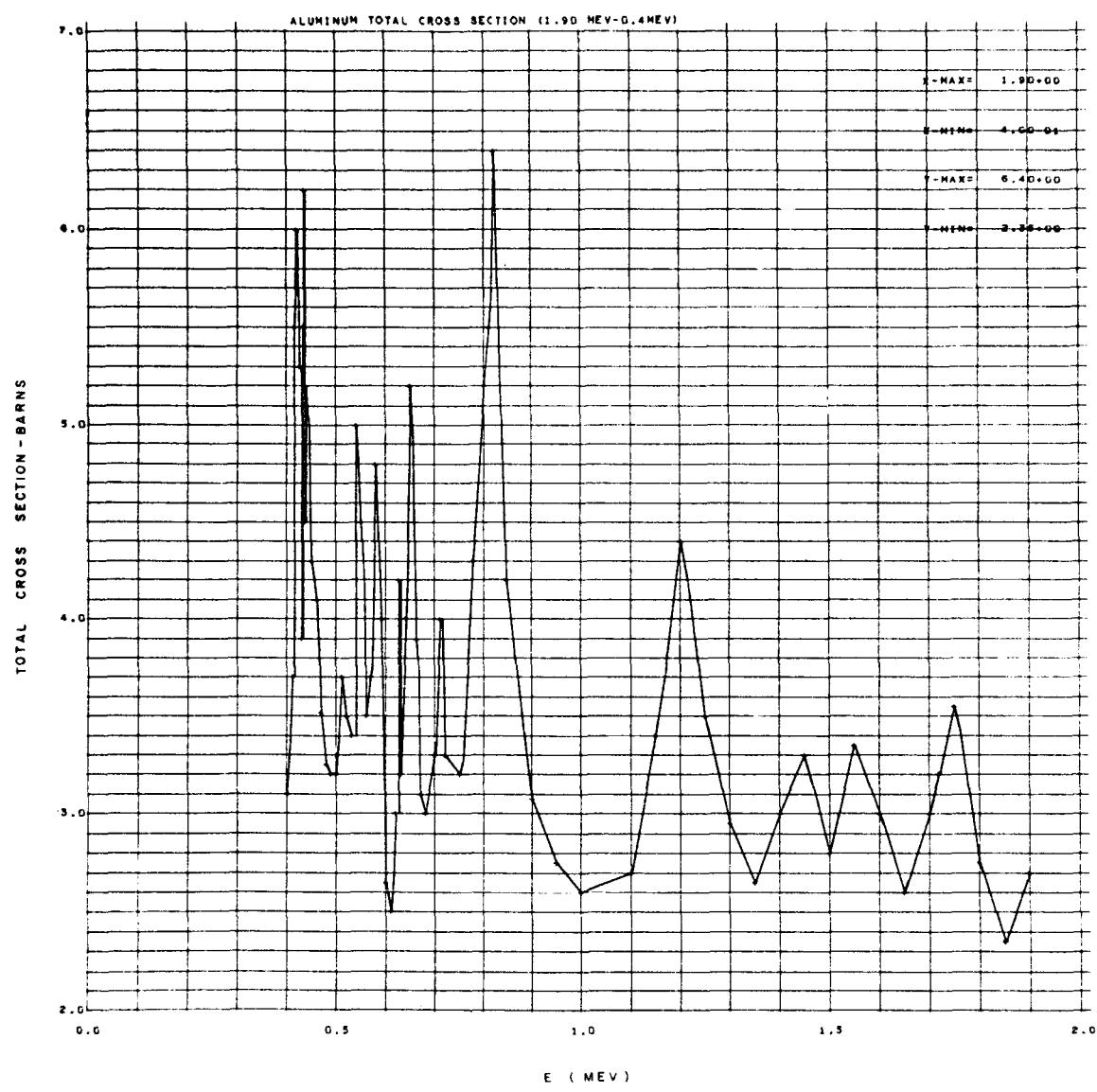


Fig. 3

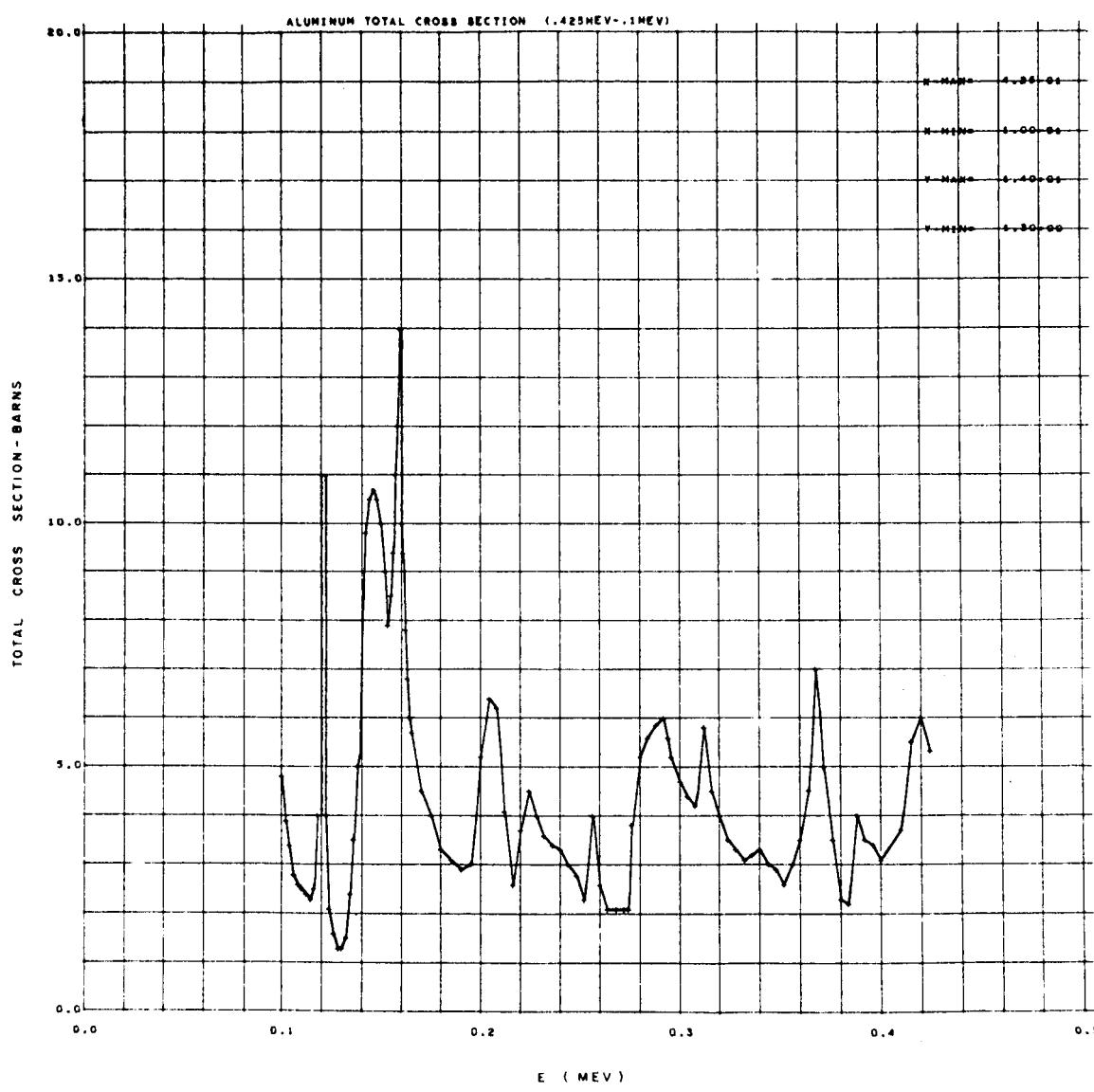


Fig. 4

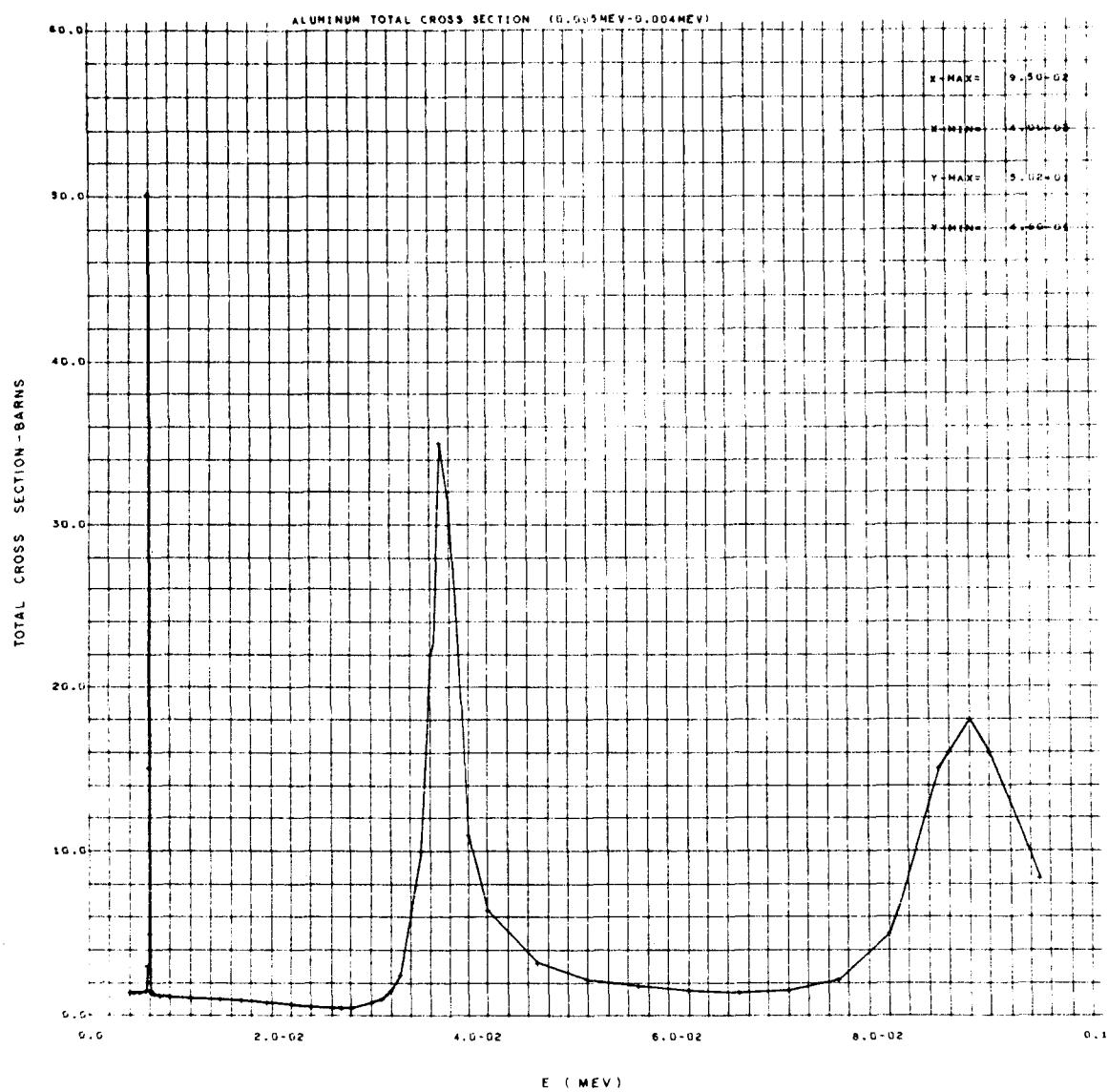


Fig. 5

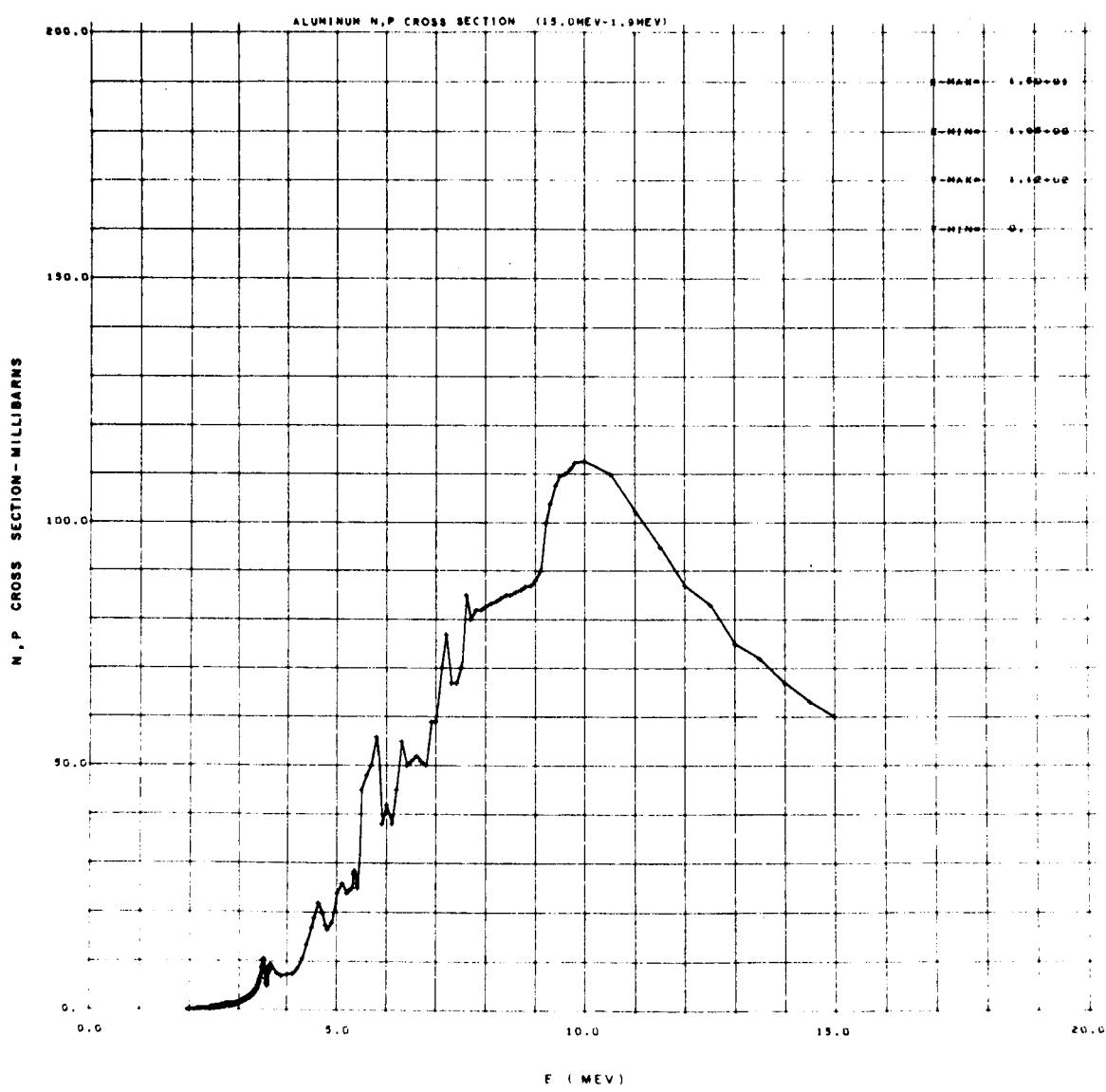


Fig. 6

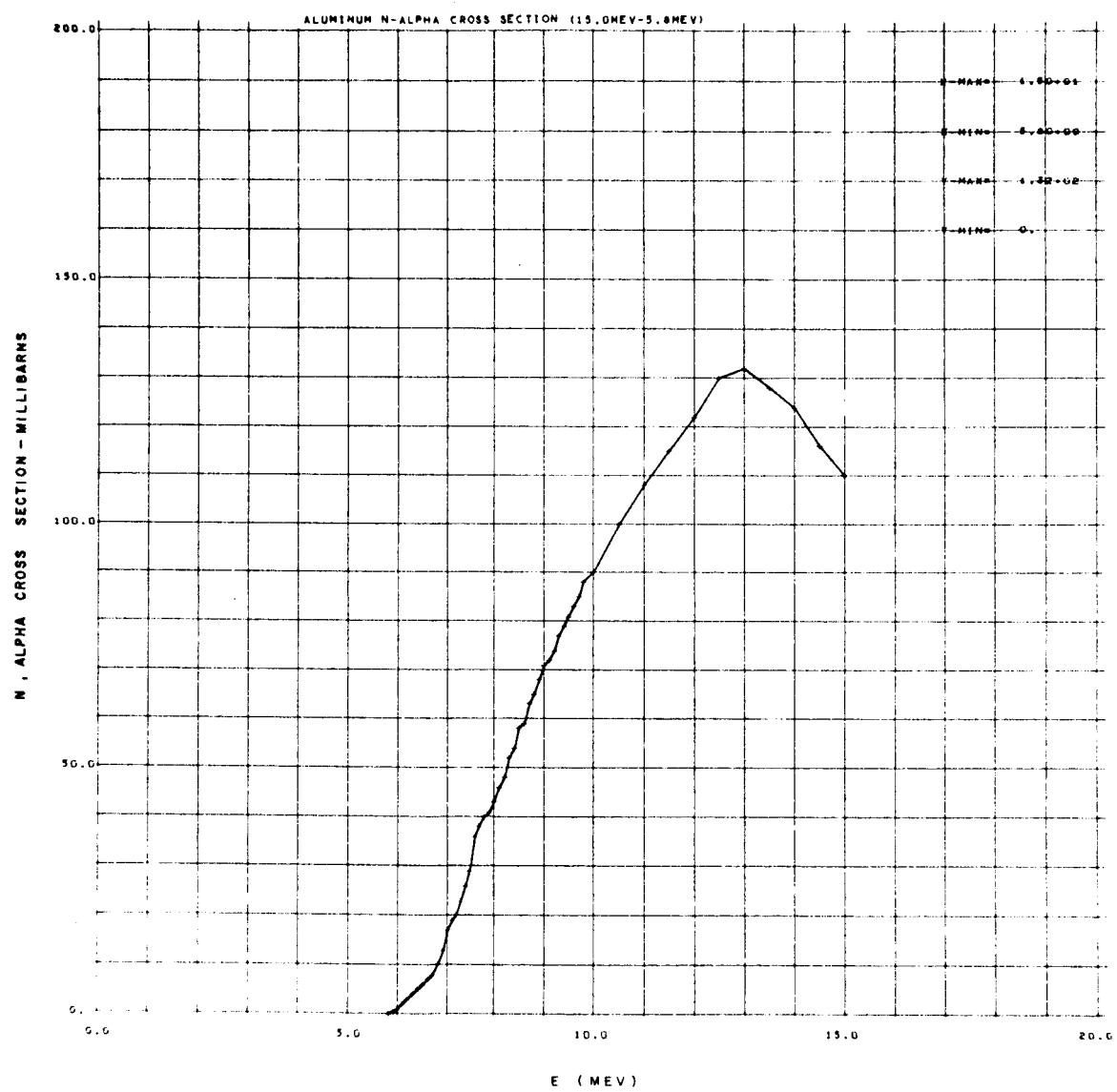


Fig. 7

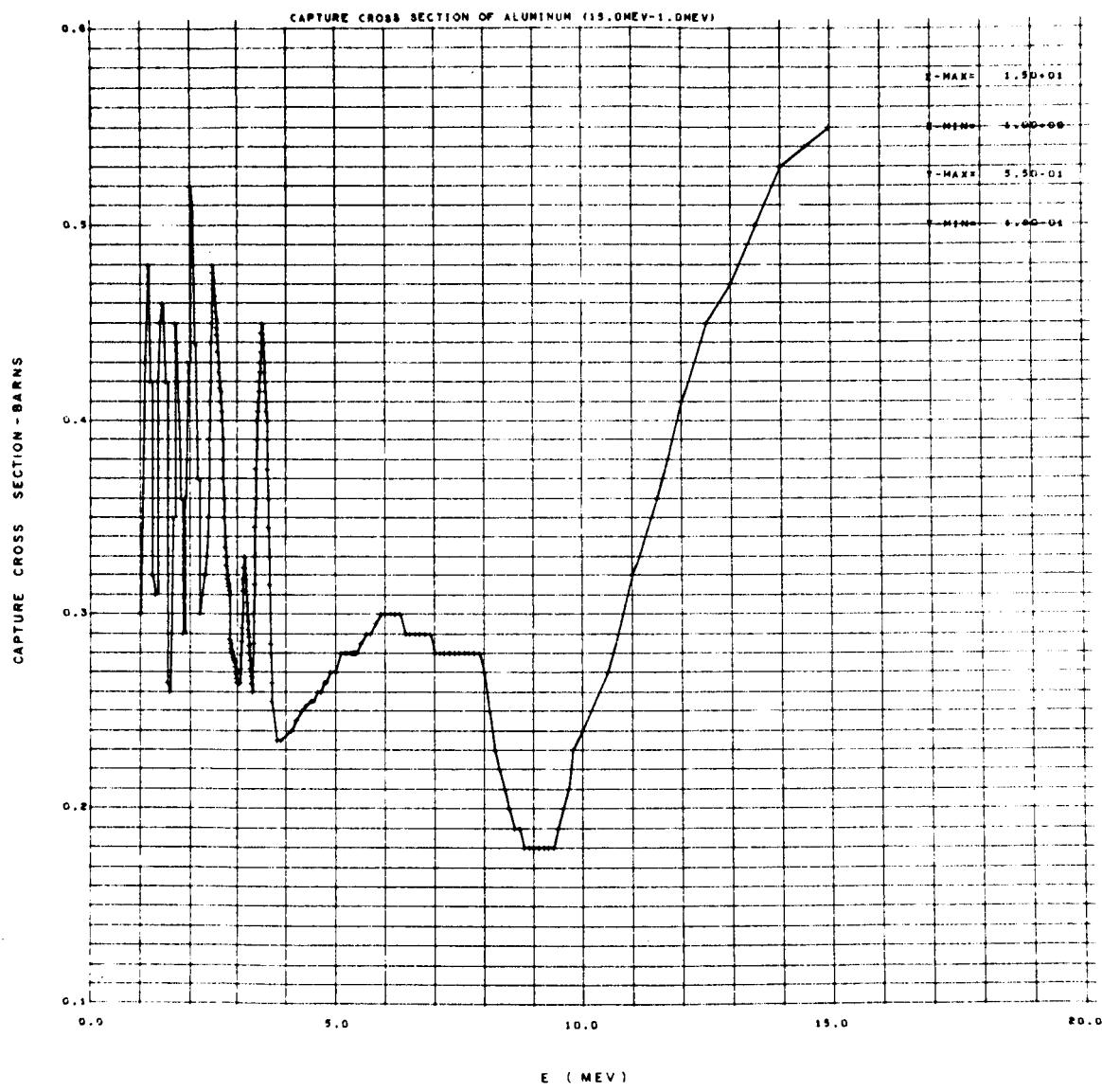


Fig. 8

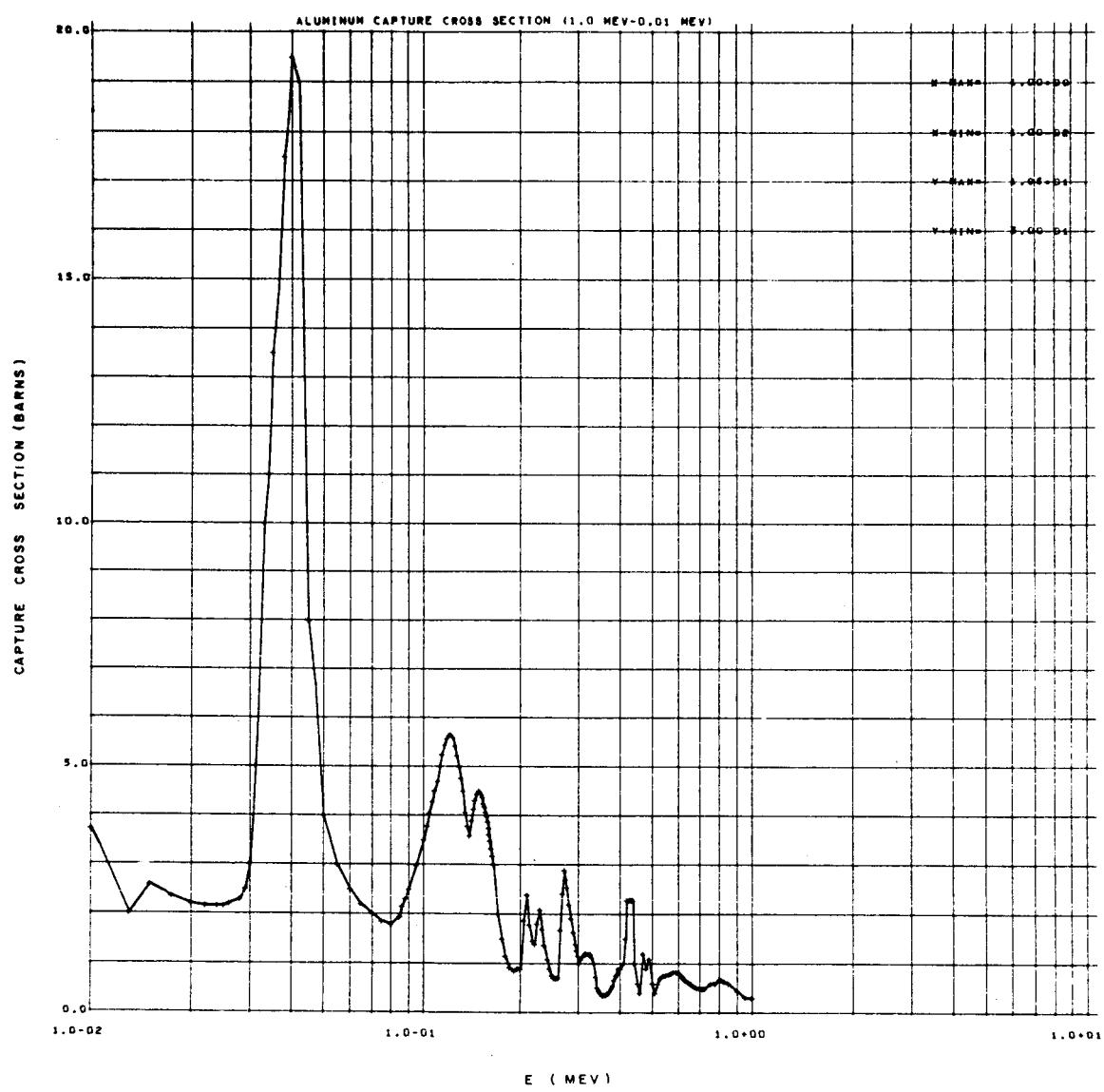


Fig. 9

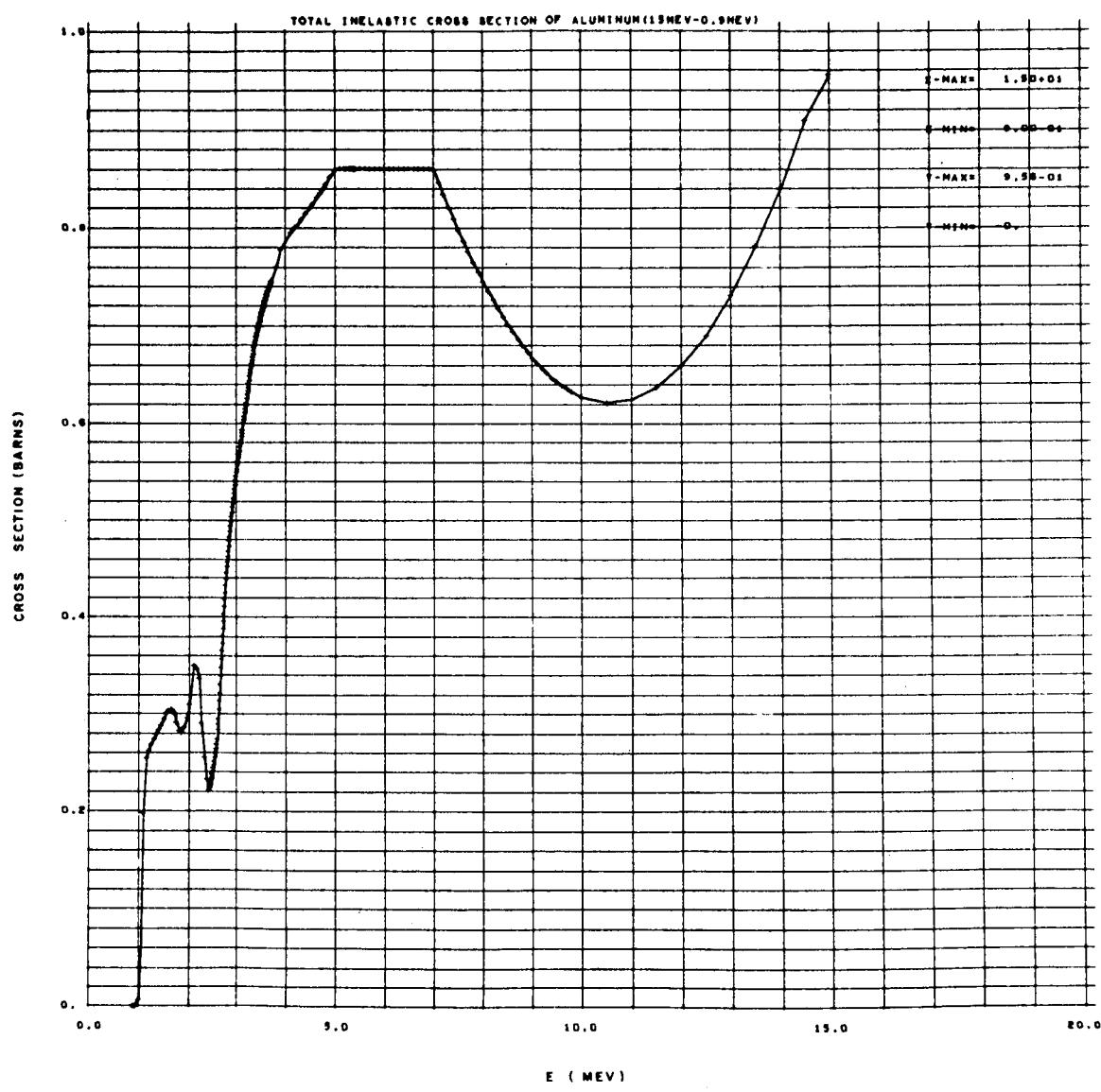


Fig. 10

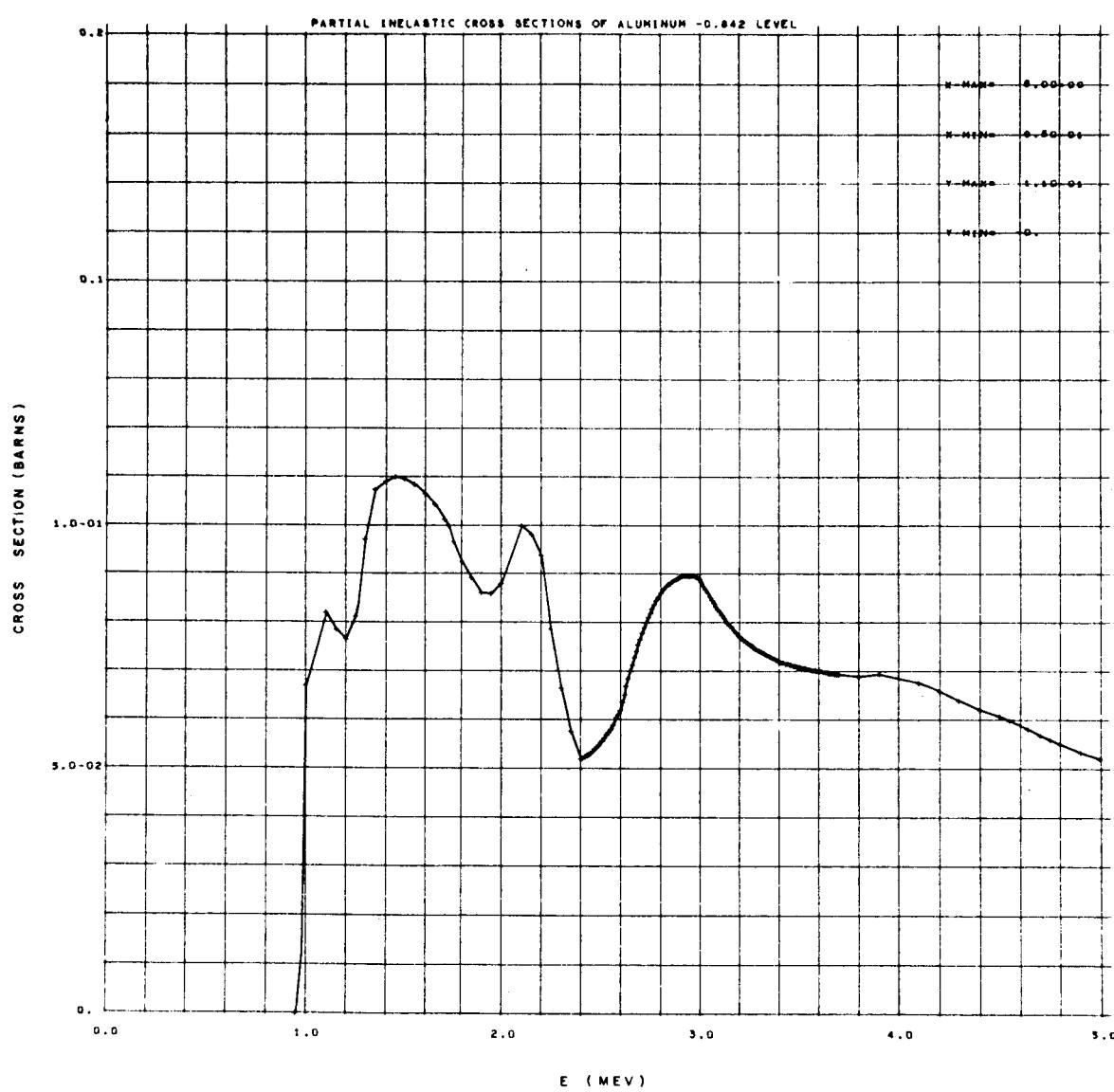


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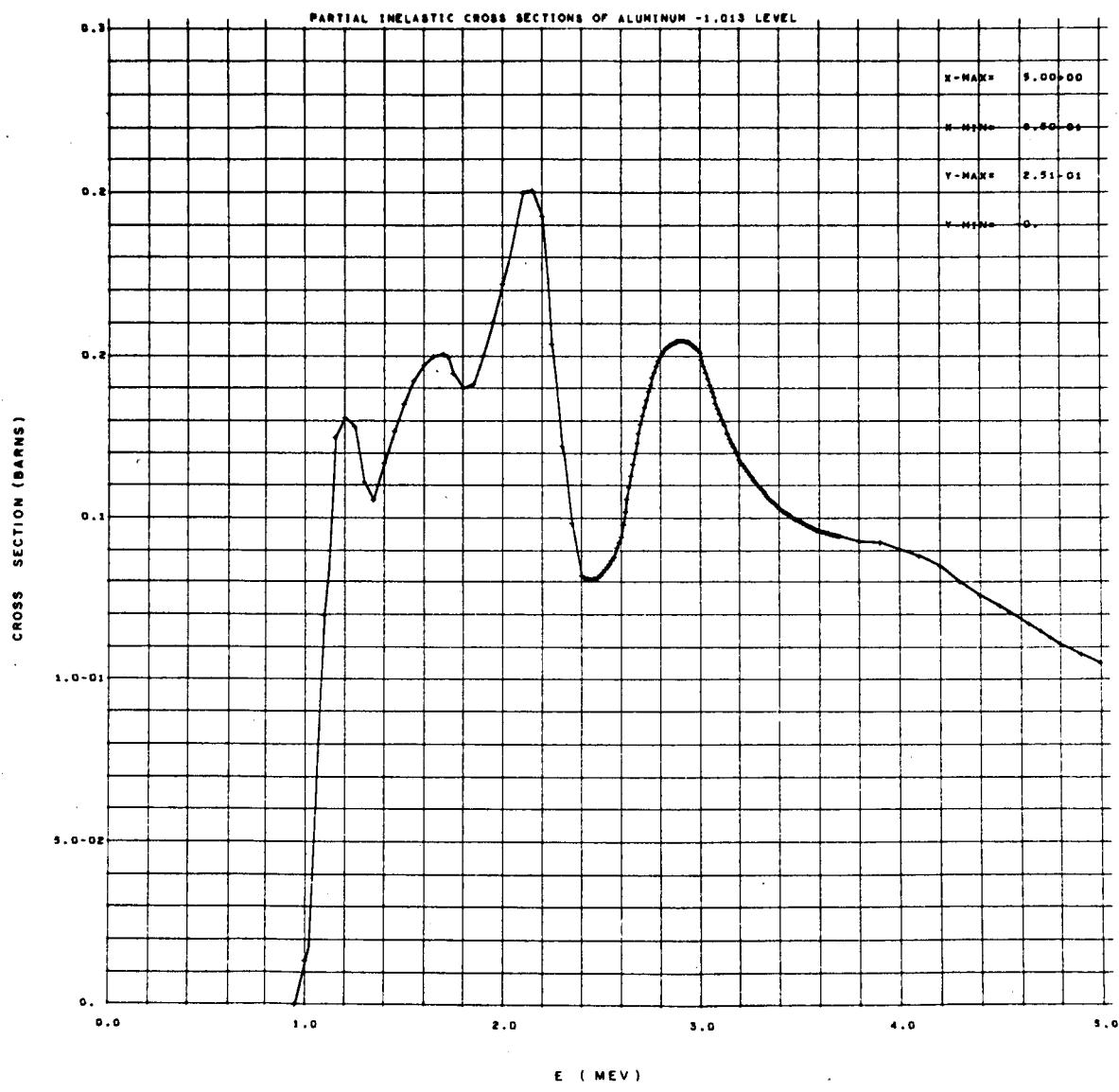


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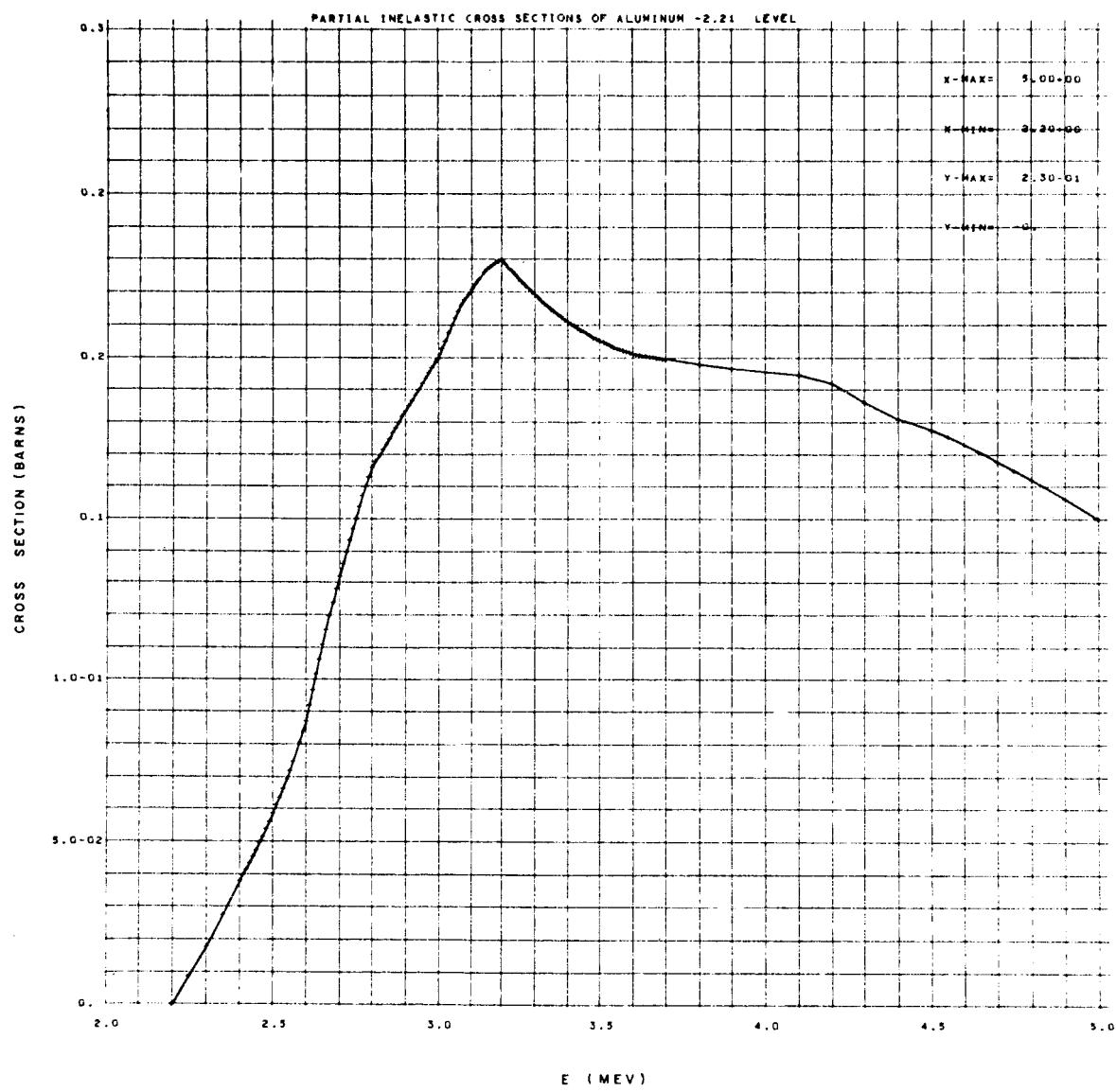


Fig. 13

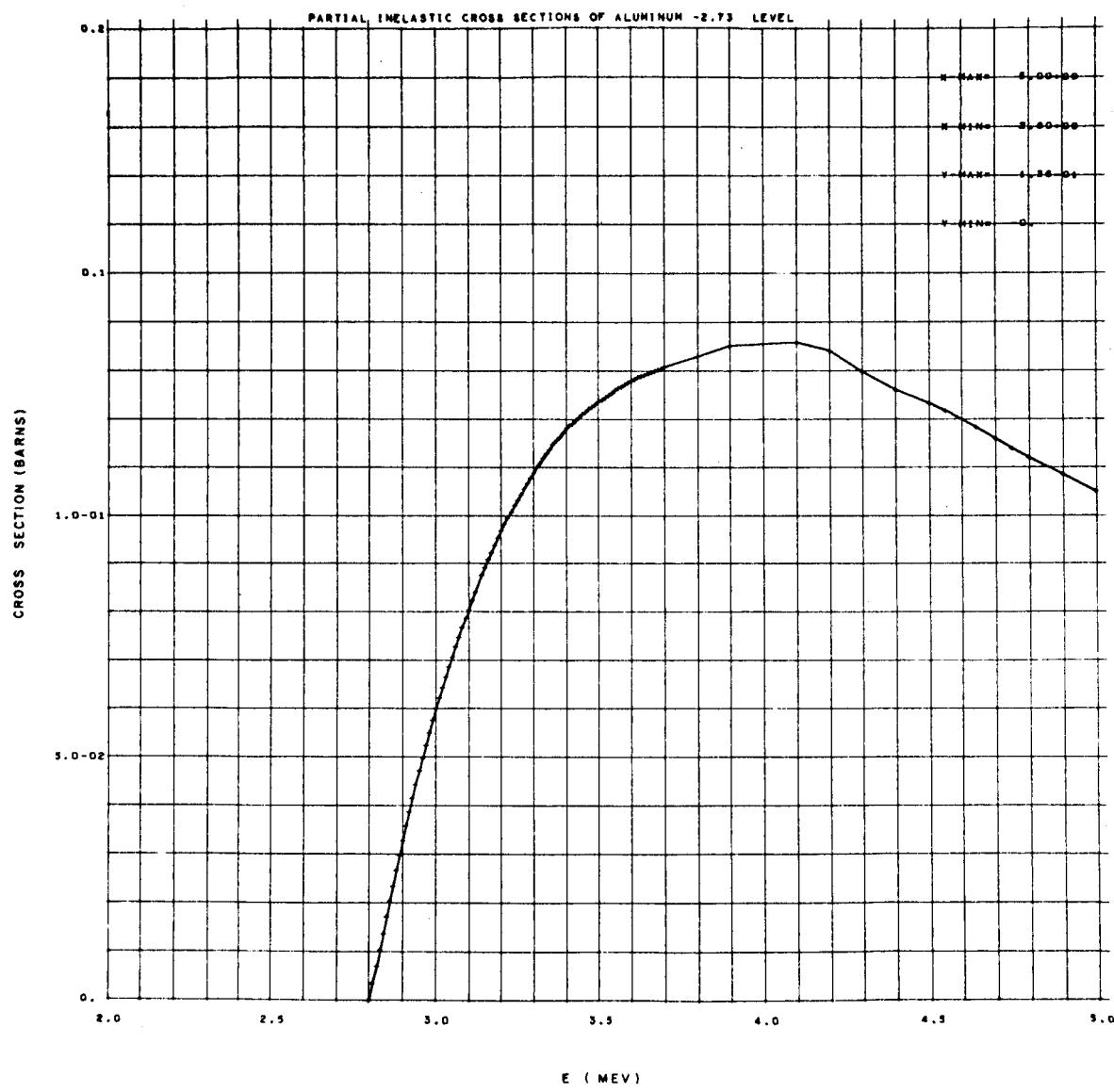


Fig. 14

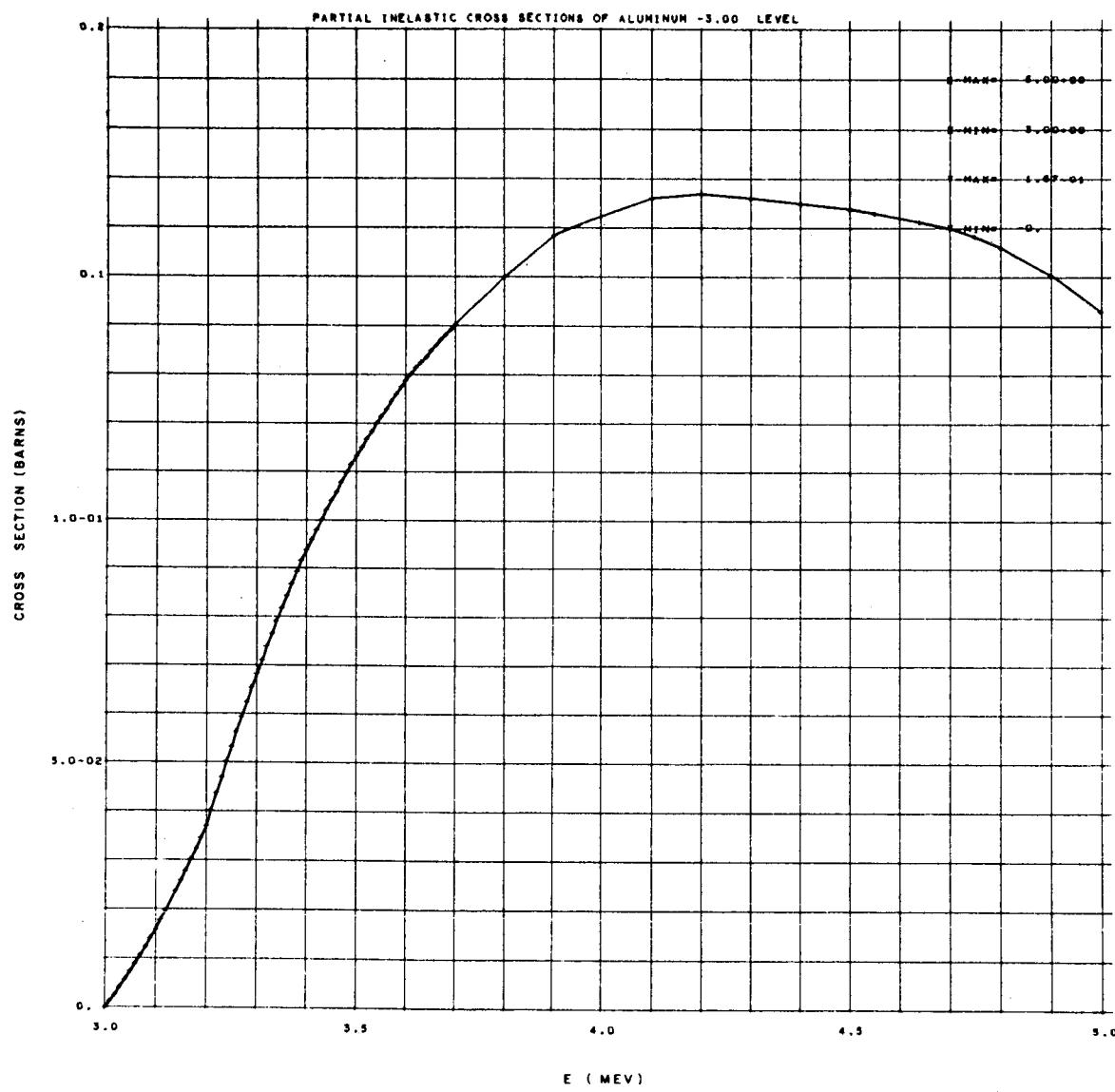


Fig. 16

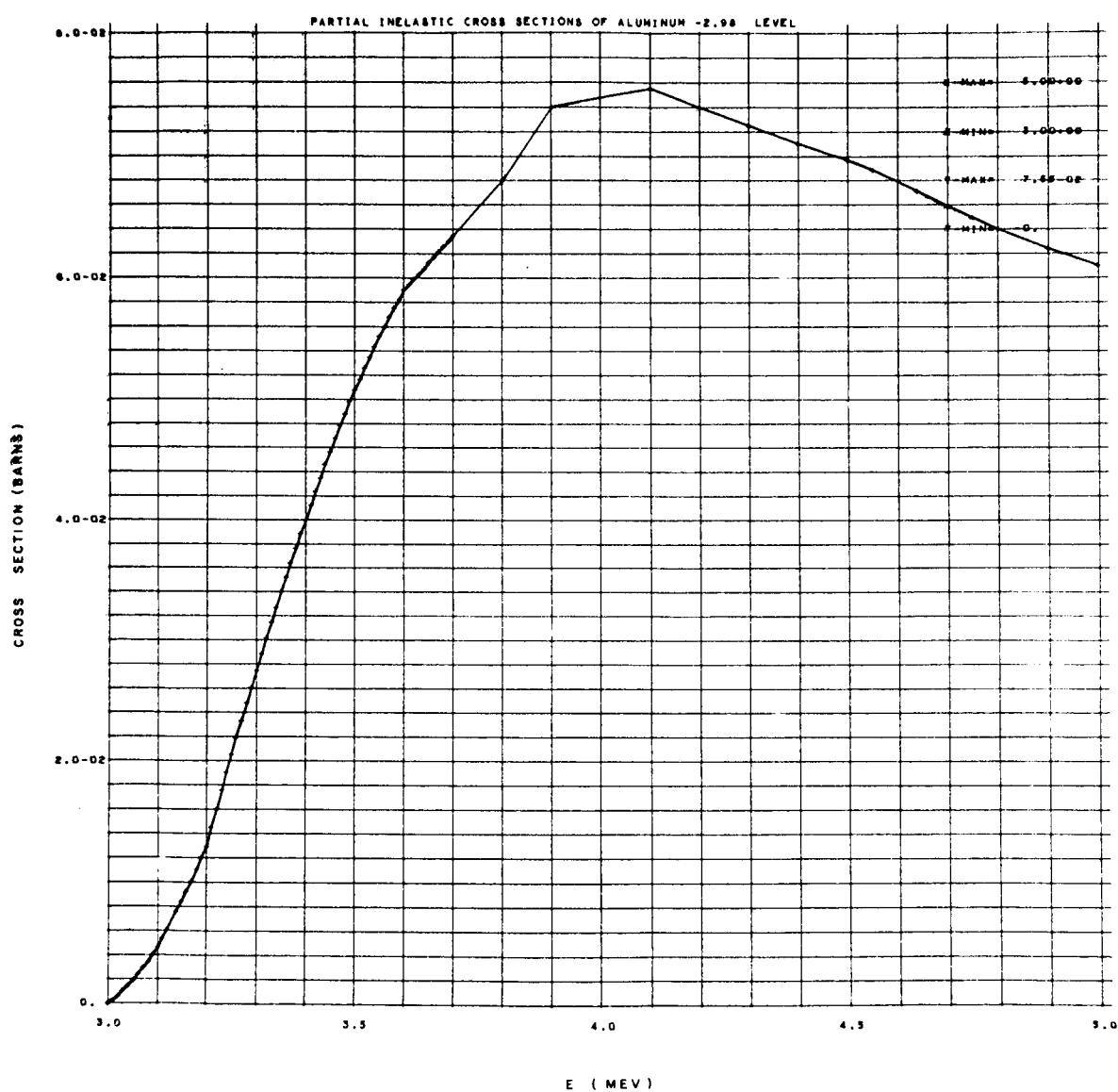


Fig. 15

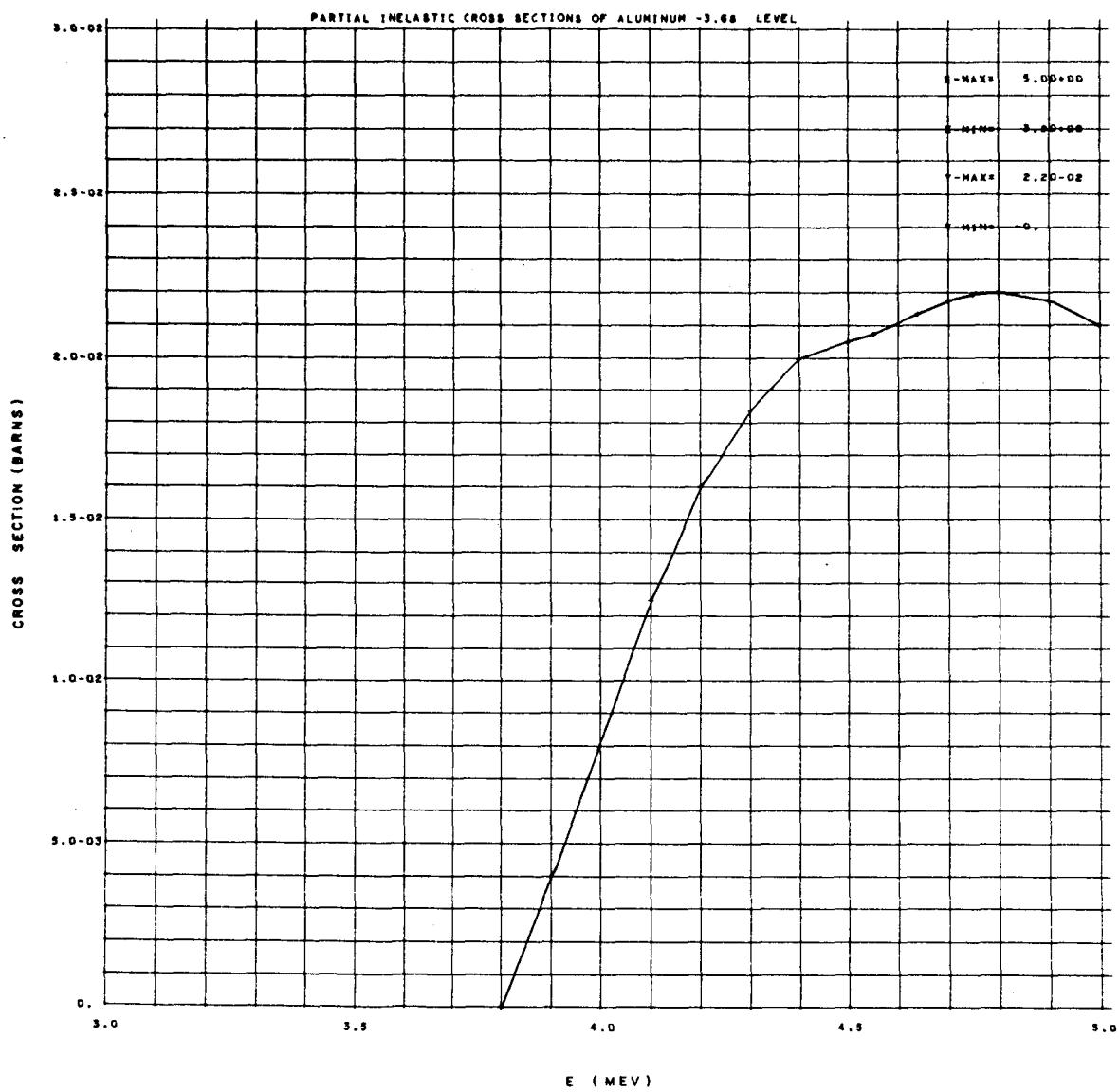


Fig. 17

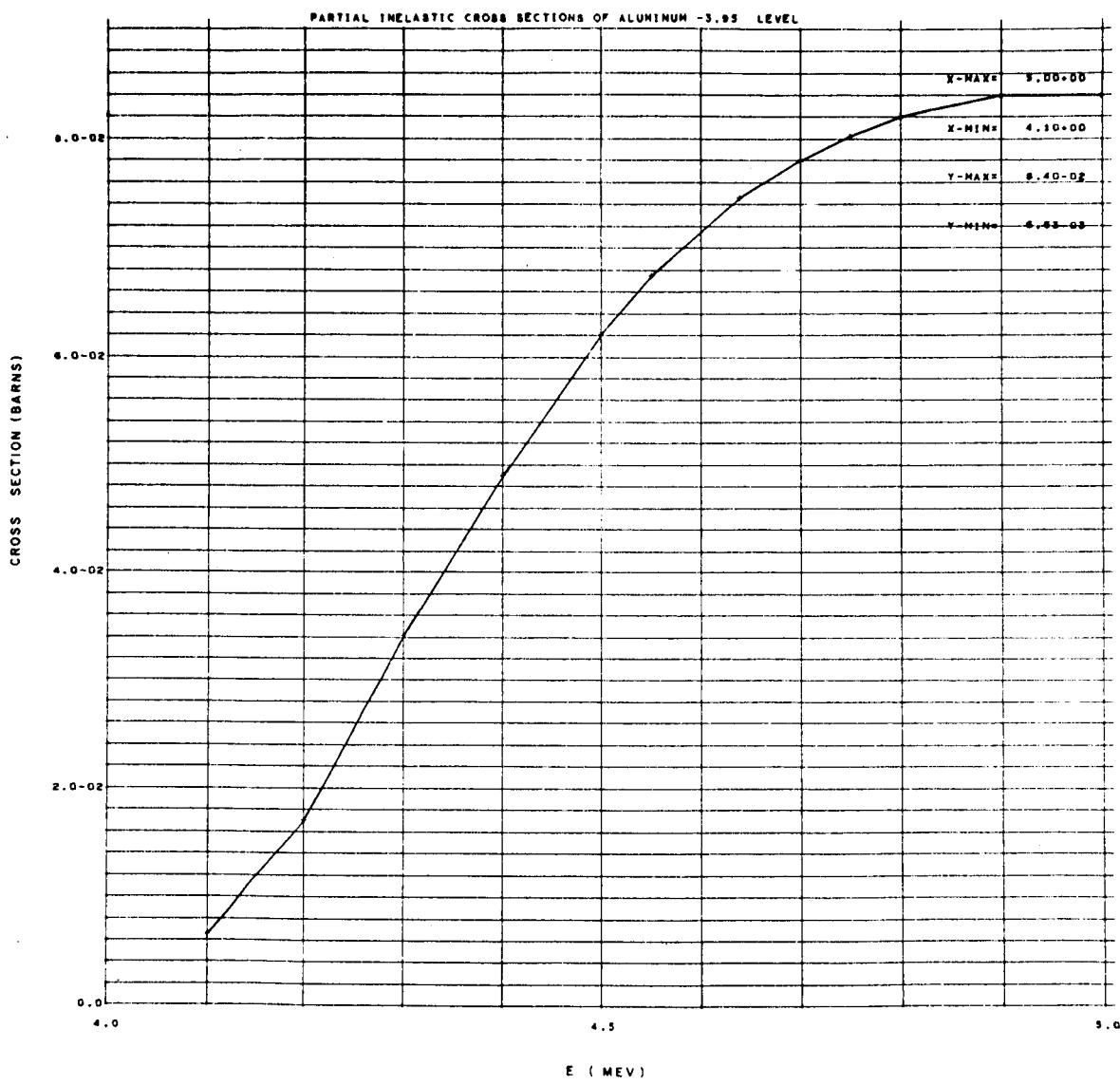


Fig. 18

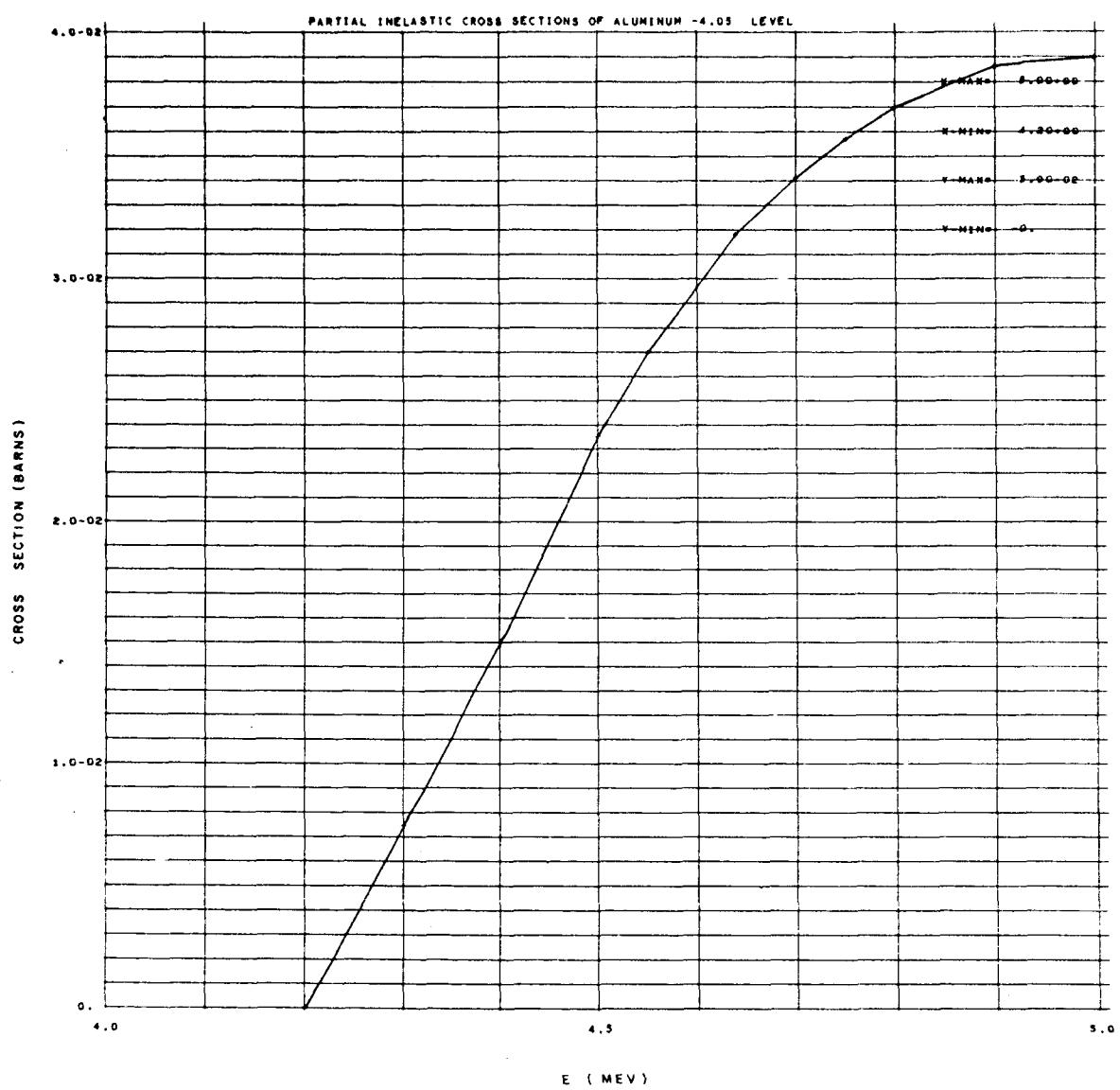


Fig. 19

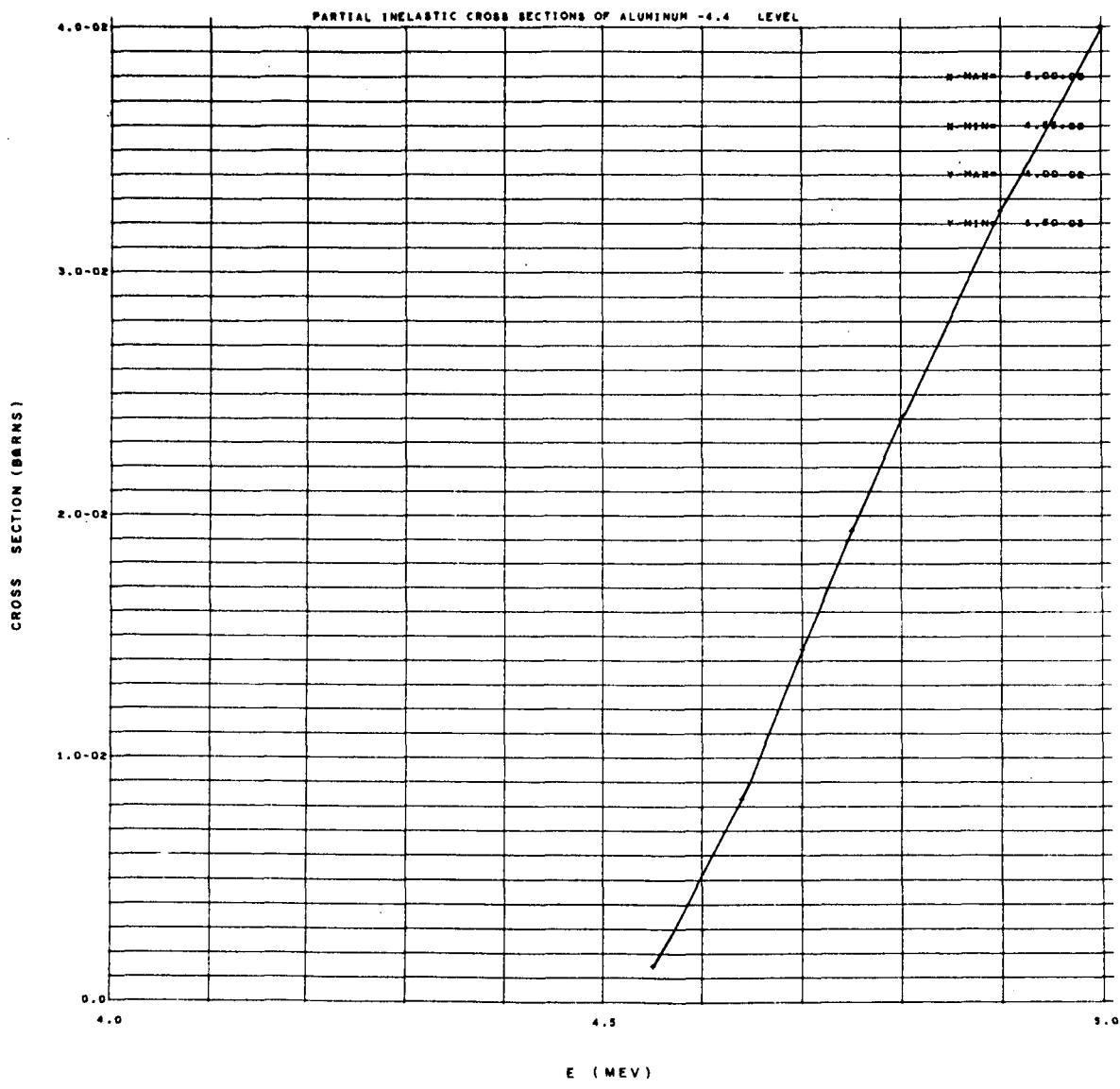


Fig. 20

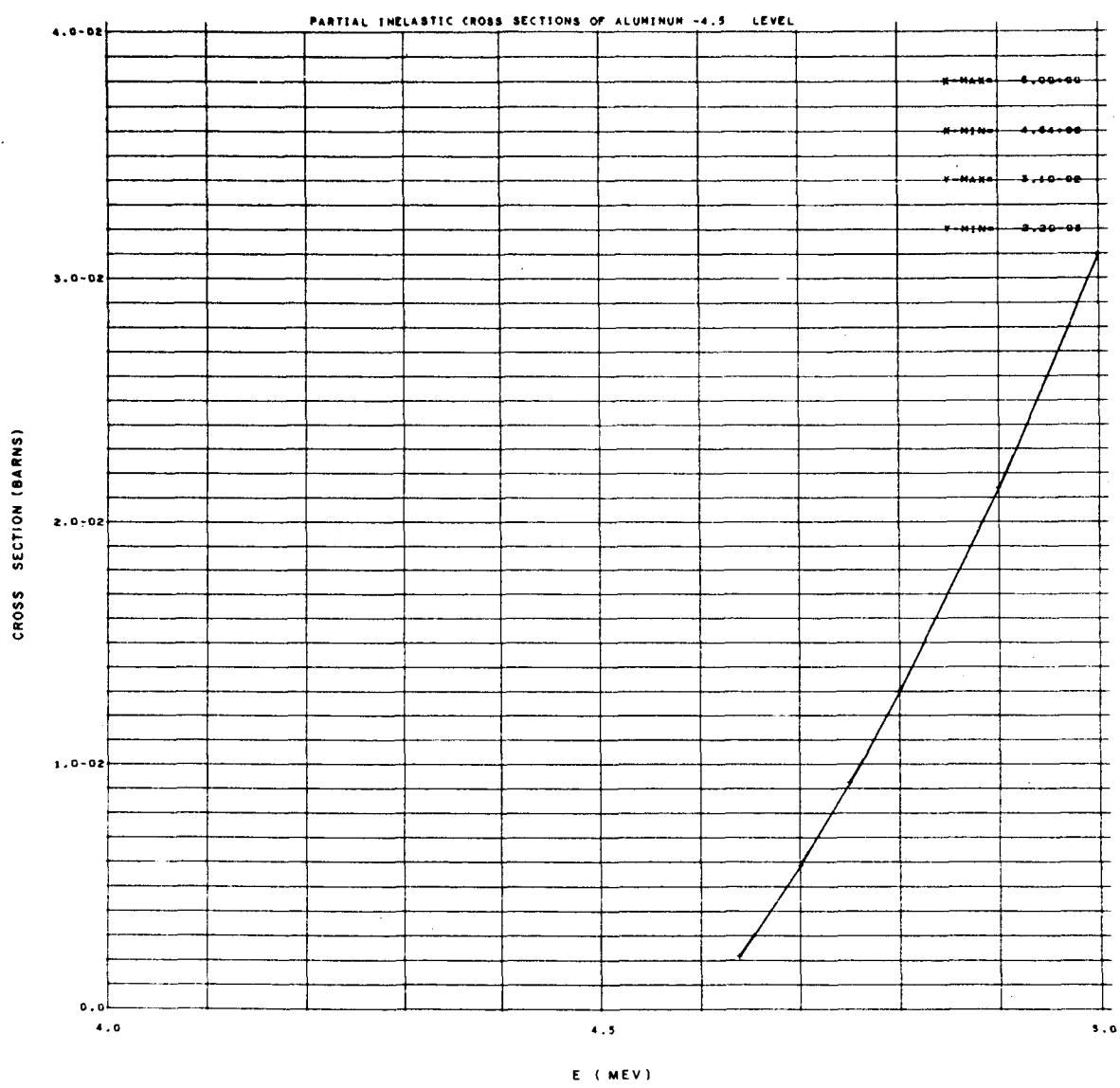


Fig. 21

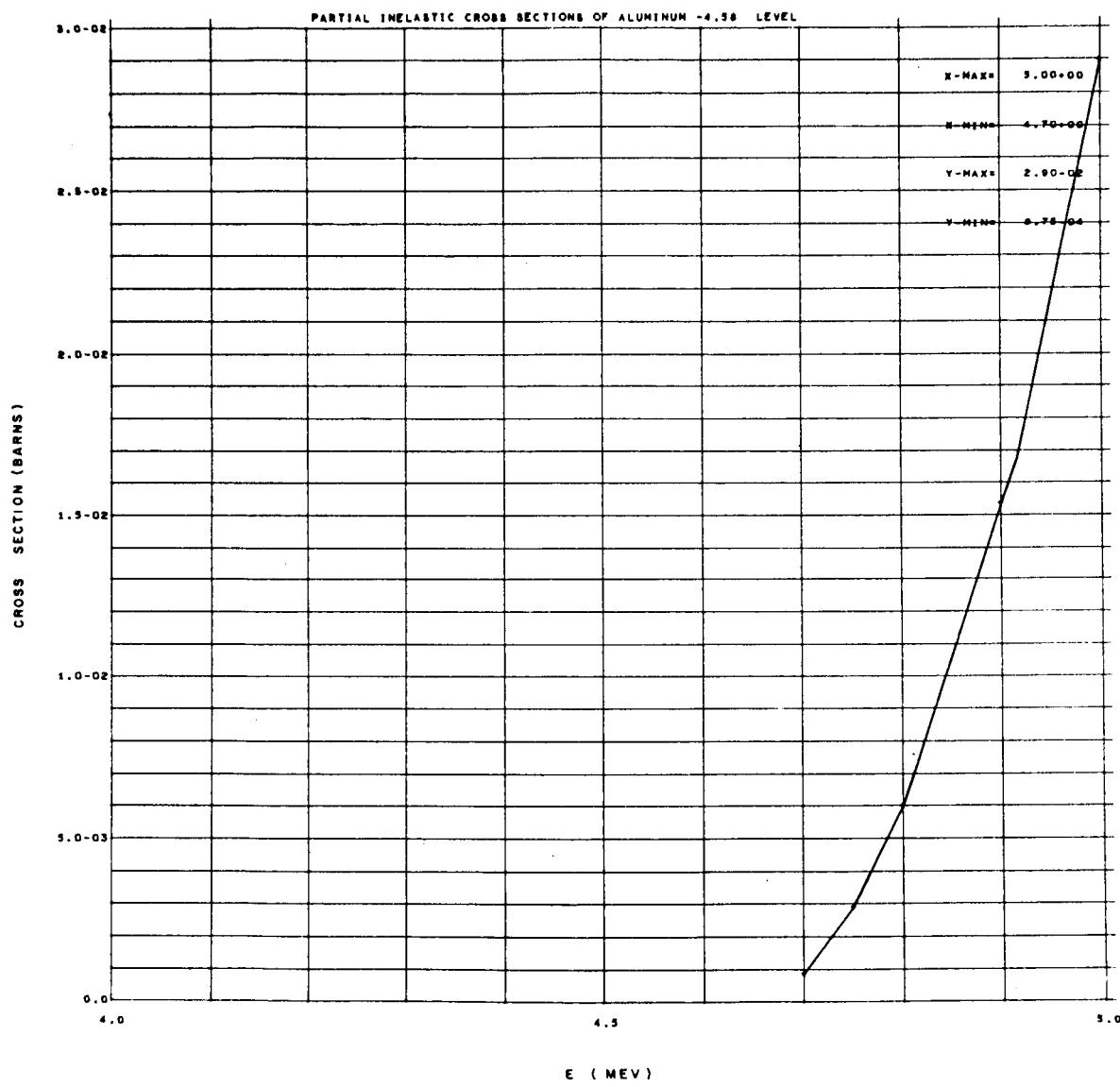


Fig. 22

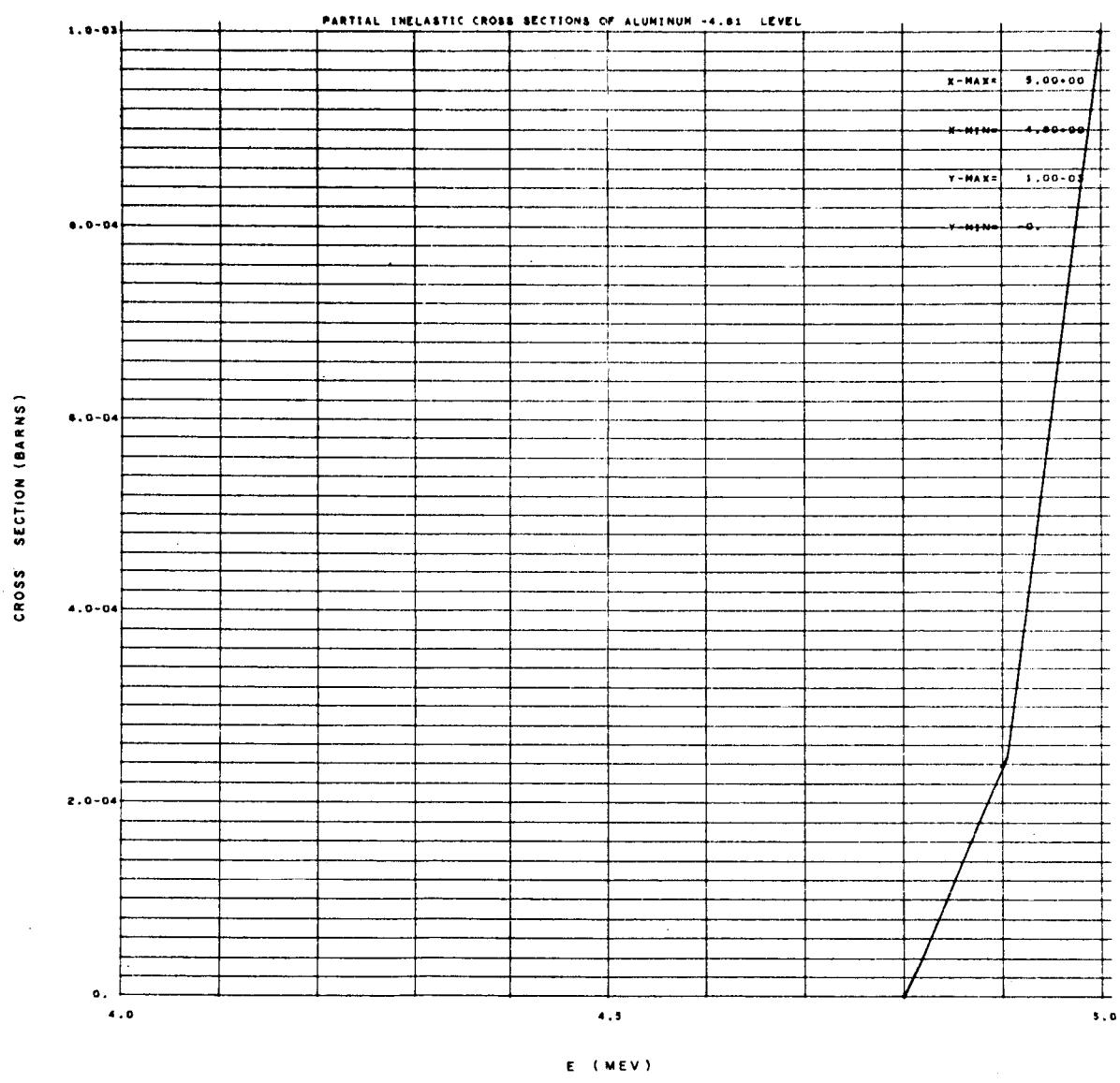


Fig. 23

REFERENCES

1. Joanou, G. D., and J. S. Dudek, "GAM-II, A B_3 Code for the Calculation of Slowing Down Spectrum and Associated Multigroup Constants," General Atomic Report GA-4265, July, 1963.
2. Vieweg, H. A., G. D. Joanou, and C. V. Smith, "GATHER-II, An IBM-7090 Fortran-II Program for the Computation of Thermal Neutron Spectra and Associated Multigroup Cross Sections," General Atomic Report GA-4132, July, 1963.
3. Howerton, R. J., et al., "Thresholds of Neutron Induced Reactions," UCRL-1400 (1964).
4. Forsberg, L., "Neutron Cross Sections for Aluminum," AE-117, Aktiebolaget Atomenergi, Stockholm (1963).
5. Stehn, J. R., M. D. Goldberg, B. A. Mugurno, and R. Wiener-Chasman, BNL-325, 2nd Ed., Supplement No. 2 (1964).
6. Hibdon, C. T., Phys. Rev., 114, 179 (1959).
7. Garg, J. B., J. L. Rainwater, and W. W. Havens, Jr., unpublished [BNL-325, 2nd Ed., Supplement No. 2 (1964)].
8. Bally, B., S. Todireanu, and S. Ripeanu, Nucl. Sci. Eng., 12, 157 (1962).
9. Ambrosino, G., and A. Sorriaux, "Total Cross-Section Measurements on Aluminum, Carbon, Fluorine and Hydrogen for d, d Reaction Neutrons Using the Coincidence Method," CEA-2399, Centre d'Etudes Nucleaires, Saclay (1963).
10. Glasgow, D. W., and D. G. Foster, Jr. (1963), unpublished [BNL-325, 2nd Ed., Supplement No. 2 (1964)].
11. Calvi, G., R. Potenza, R. Ricamo, and D. Vinceguerra, Nucl. Phys. 39, 621 (1962).
12. Wiel, J. L., and K. W. Jones, Phys. Rev. 110, 466 (1958).

13. Nereson, N., and S. Darden, Phys. Rev. 89, 775 (1953).
14. Meier, R., R. Ricamo, P. Scherer, and W. Zunti, Helv. Phys. Acta 26, 451 (1953).
15. Henkel, R. L. (1953), unpublished [BNL-325, 2nd Ed., Suppl. 2].
16. Stafford, G. H., Proc. Phys. Soc. 64A, 388 (1951).
17. Galloway, L. A., unpublished [BNL-325, 2nd Ed., Suppl. 2].
18. Bratenahl, A., J. M. Peterson, and J. P. Stoering, Phys. Rev. 110, 927 (1958).
19. Tsukada, K., and Y. C. Hau (1963), unpublished [BNL-325, 2nd Ed., Suppl. 2].
20. Vernier, J. F., and A. Mortegani, Nucl. Phys. 6, 260 (1958).
21. Hibdon, C. T., Bull. Am. Phys. Soc. Ser. II 2, 232 (1957).
22. Hughes, D. J., and R. B. Schwartz, BNL-325, Second Edition (1958).
23. Langsdorf, A., R. O. Lane, and J. E. Monahan, Phys. Rev. 107, 1077 (1957).
24. Gabbard, F., and B. D. Kern, Phys. Rev. 128, 1276 (1962).
25. Moni, G. S., G. J. McCallum, and T. G. Ferguson, Nucl. Phys. 19, 535 (1960).
26. Hudson, O. M., Jr., and I. L. Morgan, Bull. Am. Phys. Soc. 4, 372 (1963).
27. Butler, J. P., and D. C. Santry, Can. J. Phys. 41, 372 (1963).
28. Tewes, H. A., A. A. Caretto, A. E. Miller, and D. R. Nethaway, unpublished.
29. Allen, D. L., Nucl. Phys. 24, 274 (1961).
30. Hassler, F. L., and R. A. Peck, Jr., Phys. Rev. 125, 1011 (1962).
31. Bramlett, E. T., R. W. Fink, D. G. Gardner, and A. Poularikas, Phys. Rev. 125, 297 (1962).

32. Kumake, I., A. D. Poularikas, I. L. Preess, D. G. Gardner, and R. W. Fink, Phys. Rev. 117, 1568 (1960).
33. Poularikas, A., and D. G. Gardner, "Annual Progress Report," Nucl. Chem., 14 (1963).
34. Block, R. C., W. Hoeberk, and H. W. Newson, Phys. Rev. 109, 1620 (1958).
35. Langsdorf, A., Jr., R. O. Lane, and J. E. Monahan, ANL-5567 (1956).
36. Lovchikova, G. N., Atomnaya Energiya 2, 174 (1957).
37. Beyster, J. R., M. Walt, and E. W. Salmi, Phys. Rev. 104, 1319 (1956).
38. Little, R. N., Jr., B. P. Leonard, Jr., J. T. Prud'homme, and L. D. Vincent, Phys. Rev. 98, 634 (1955).
39. Walt, M., and J. R. Beyster, Phys. Rev. 98, 677 (1955).
40. Hill, R. W., Phys. Rev. 109, 2105 (1958).
41. St. Pierre, C., M. K. Machine, and P. Lorrain, Phys. Rev. 115, 999 (1959).
42. Anderson, J. D., C. C. Gardner, J. W. McClure, M. P. Nakada, and C. W. Wong, Phys. Rev. 115, 1010 (1959).
43. Goldberg, M. D., V. M. May, and J. R. Stehn, BNL-400 (1962).
44. Poole, M. J., Phil. Mag. 43, 1060 (1952).
45. Tsukada, K., S. Tanaka, M. Maruyomi, and Y. Tomita, "Physics of Fast and Intermediate Reactors," Phys. Fast Intermediate Reactors, Proc. Seminar, Vienna, Vol. 1, 1962, p. 75.
46. Whitehead, W. D., and S. C. Snowden, Phys. Rev. 92, 114 (1953).
47. Weddel, J. B., Phys. Rev. 104, 1069 (1956).
48. Thompson, D. B., Phys. Rev. 129, (1963).
49. Yuasa, K., J. Phys. Soc. Japan 13, 1248 (1958).

50. Coon, J. H., R. W. Davis, H. E. Felthauser, and D. B. Nicodemus, Phys. Rev. 111, 250 (1958).
51. Khaletskii, M. M., Dokl. Akad. SSSR 2, 152 (1957).
52. Glazkov, N. P., Atomnaya Energuya, 15, 416 (1956).
53. Winterhalter, D., Nucl. Phys. 43, 339 (1963).
54. Towle, J. H., and W. D. Gilbay, Nucl. Phys. 39, 300 (1962).
55. Moni, G. S., G. J. McCallum, and A. T. Ferguson, Nucl. Phys. 19, 535 (1960).

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(GA-5884)

NEUTRON CROSS SECTIONS FOR ALUMINUM

by

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The following errata should be noted in Report NASA CR-54260
(GA-5884):

Title page--

Change the Technical Manager's identification to read

Technical Management
NASA Lewis Research Center
Cleveland, Ohio
Nuclear Reactor Division
D. Bogart

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Add the following addressee to the Distribution List:

National Aeronautics and
Space Administration (2)
Washington, D.C. 20546
Attn: Nuclear Propulsion Office